

- Rape poisoning 211
 Rectal prolapse 74
 Rectourethral fistula 20
 Rectovaginal fistula 170
 Rednose 75-76
 Redwater fever 196-197
 Renal calculi 152-154
 Renal failure 210
 Renal infarction 83
 Respiratory syncytial virus 78
 Retained placenta 167, 170-171
 brucellosis 176
 uterine prolapse 174
 Reticulitis, traumatic 64, 87
 Reticuloperitonitis 64, 65, 70
 Retropharyngeal swellings 60-61
Rhabditis bovis 36
 Rickets 125, 126
 Rickettsial infections 195-202
 Rift Valley fever 194
 Rinderpest 191-192
 Ringworm 35
 Rumen
 acidosis 89, 96, 104
 atony 140
 bloat 25, 63, 140
 fistula 20
 flukes 71
 neoplasia 63
 tympany 63
 Rumenitis 62, 73
 Ruminoreticular distension 65
 Rupture
 bladder 153-154
 cranial cruciate ligament 114
 deep flexor tendon 94, 96
 median suspensory apparatus 188
 prepubic tendon 45, 167
 uterus 168
 ventral serrate muscle 122
- Sacrococcygeal fracture 112
 Sacroiliac subluxation 111
Salmonella 21
 dublin 23
 typhimurium 23
 Salmonellosis 23
 Salt-craving pica 149
 Sandcracks, hoof wall 101-102
Sarcoptes scabiei 32
 Sarcoptic mange 32-34
 Scabies 32-34
 Schistosomiasis 72
 Schistosomus reflexus 10
 Sciatic paralysis 119
 Scirrhus cord 161
 Scissor claw 103
 Scleral haemorrhage 134
 Scour 21-23, 25-26
 Screwworm 42
 Scrotal conditions 159-162
 Selenium
 deficiency 123, 170
 toxicity 213
- Seminal vesiculitis 162
 Shipping fever 77, 145
 Skin
 abscesses 44
 congenital absence 13
 helminths 36-37
 lymphosarcoma 207
 necrosis 46
 parasitic conditions 32
 tuberculosis 39
- Slow fever 141
 Slurry fever 100
 Snake bites 29
Solanum malacoxylon 212
 Sole
 disorders 89-93
 overgrowth 103
 ulceration 94, 95-96, 103
- Solenopotes capillatus* 34
 Spastic paresis 120
 Spina bifida 8, 12
 Spinal conditions 109-112
 Splenic fever 203
 Spondylitis 111
 Sporadic bovine encephalomyelitis 200
 Squamous cell carcinoma 136-137
 Squint 129-130
 Staggers 140
Staphylococcus 18, 34, 178, 179, 186
 Staphyloma 133
Stephanofilaria 32, 36
 Stephanofilariasis 36
 Stomatitis
 bovine papular 52, 181
 erosive 49-51
 vesicular 52, 183
- Strabismus 129-130
Streptococcus 86, 144
 agalactiae 179, 180
 dysgalactiae 177, 179, 180
 uberis 178
 Streptothricosis 38
 Submandibular abscess 60
 Supernumerary teats 186
 Sweating sickness 200
 Swellings
 head 56-60
 pharynx 60-61
 Swollen face 59
 Syndactyly 13
- Taenia multiceps* 146
 Tail
 constriction 46
 gangrene 124
 hypoplastic 12
 paralysis 112
 Tarsal conditions 117-118
 Teat conditions 181-186
- Teeth 55-56
 Tendons
 congenital contraction 11
 deep flexor 94, 96
 prepubic 45
- Tenosynovitis 116, 118
 Teratogens 7
 Testicular hypoplasia 156
 Tetanus 161, 205
 Tetany 140
Tetrapterys species 213
 Theileriosis 198
 Three-day sickness 194
 Thromboembolism, pulmonary 73, 82-83
 Thymic lymphosarcoma 207
 Thyroid, enlarged 28
 Tick-borne diseases 195-202
 Torsion
 abomasal 68
 caecal 68
 jejunal 69
 uterine 169
- Toxins *see* Poisons
 Transit fever 77
 Transmissible necrosis 200
 Traumatic reticulitis 64, 87
Trichophyton verrucosum 35
Trichostrongylus axei 54
Trisetum flavescens 212
 Trypanosomiasis 203
 Tsetse flies 203
 Tuberculosis 39, 80
 Tumours *see* Neoplasia
- Udder conditions 186-188
 Ulcerative lymphangitis 39
 Ulcers
 abomasal 24, 66
 corneal 132
 sole 94, 95-96, 103
- Umbilicus 17-20
 Urethra
 obstruction 153
 rupture 153, 161
- Urolithiasis 152-154
 Urticaria, cutaneous 29
 Uterus
 aplasia 164
 fibromyoma 167
 prolapse 174
 rupture 168
 torsion 169
- Uterus unicornis 164
 Uveitis 136
- Vaccinia 181, 183
 Vagal indigestion 65
 Vaginal polyp 174
 Vaginal prolapse 173
 Vaginal wall, rupture and haemorrhage 169

- Mummified foetus 175
Musca 37
autumnalis 40
domestica 41
Muscular dystrophy 123
Mycobacterium paratuberculosis 53
tuberculosis bovis 80, 160
Mycoplasma mycoides mycoides 79
Mycotic abortion 176
Mycotoxicoses 214-215
Mycotuberculosis, atypical 39
Myelomeningocele 12
Myiasis 42
Myocarditis 87
Myositis, septic 122
- Naphthalene toxicity 215
Navel 17-20
Neck bursitis 43
Necrobacillosis 27, 101
Necrosis
abdominal fat 73
cerebrocortical 139
ear 23, 45, 202
hepatic 194
muscle 106, 108, 119
scrotal 161
septic carpalis 115
skin 46
transmissible 200
Necrotic cellulitis 59
Necrotic dermatitis 187
Necrotic hepatitis 72
Neoplasia
alimentary tract 63, 210
bladder 210
female genital tract 166-167
ocular 136-137
pharyngeal 60
ruminal 63
Nervous acetonaemia 141
New Forest disease 132-133
Nitrate/nitrite toxicity 216
Nodular endocarditis 86
- Oak poisoning 210
Obturator paralysis 109
Obstruction
abomasum 65
intestinal 13, 69, 70, 73
milk flow 186
nasal 72
oesophageal 61, 63
urethral 153
Oesophagostomum infection 55
Omasitis 62
Omphalophlebitis 18, 20
Onchocerca 36
Ondiri disease 201
Opisthotonos 144
Oral necrobacillosis 27
Orchitis 160
- Organophosphorus toxicity 216
Osteochondrosis dissecans 122
Osteomalacia 125, 126
Osteomyelitis
distal phalangeal fracture 91, 104
metacarpal fractures 114
pedal bone 91
spinal 110
Ostertagia ostertagi 54
Ostertagiasis 54
Otitis 36, 142
Ovaries 165-166
- Palatoschisis 7
Panters 81
Papilloedema 131
Papillomata 38-39
interdigital space 99
third eyelid
Parafilaria 36, 40
bovicola 37
Parafilarial infection 37
Parakeratosis 14
Paralyses 119-120
femoral 119
obturator 109
peroneal 120
radial 120
sciatic 119
tail 112
Paramphistomiasis 71
Parasitism
gastrointestinal 54-55
otitis 36
skin 32
Paratuberculosis 53
Paravaccinia 181-182
Parotid lymph nodes 60
Pasteurella 144
haemolytica 75-76, 86
Pasteurellosis 77, 145
Patellar luxation 113, 119
Patent ductus arteriosus 15
Pectoral amyotonia 11
Pedal arthritis 93-94
Pediculosis 34
Peito inchado 213
Pelodera (Rhabditis bovis) 36
Pelvic fracture 112
Penile conditions 157-158
Peptococcus indolicus 177
Pericarditis, septic 87
Periostitis, alveolar 59
Peritonitis 70
Peroneal paralysis 120
Persistent frenulum 156
Petechnial fever 201
Pharyngeal swellings 60-61
Phlegmona interdigitalis 96-97
Phosphorus deficiency 125, 126
gastrocnemius trauma 118
pica 206
Photophobia 132, 193
- Photosensitive dermatitis 16, 30-31, 214-215
Physitis, septic 110
Pica
botulism 206
osteomalacia 126
salt-craving 149
Pine 128
Pink tooth 16
Pinkeye 132-133
Pithomyces chartarum 214-215
Placenta, retained *see* Retained placenta
Placentitis 176
Plant toxicoses 7, 209-214
Pleurisy 79
Pneumonia 77-82, 145
Poisons
fungal 214-215
inorganic chemicals 216-217
organic chemicals 215-216
plants 7, 209-214
Polyarthritis 28
Polyps 174
Popliteal abscess 122
Porphyria, erythropoietic 16
Post-partum complications 169-174
Post-parturient paresis 140
Posterior vena cava thrombosis 73
Posthitis 159
Premature calf 175
Prepubic tendon - rupture 45, 167
Preputial conditions 158-159
Prolapse
cervical 174
eyeball 135
rectal 74
uterine 174
vaginal 173
Proptosis 135
Proteus 18
Protozoal infections 195-202
Pruritis
Aujeszky's disease 147
lice 34
psoroptic mange 33
Pruritis-pyrexia-haemorrhagica 148
Pseudocowpox 181-182
Pseudohermaphrodite 155
Pseudorabies 147
Pseudotuberculosis 39
Psoroptes 32-33
Psoroptic mange 33
Pubic fracture 112
Pulmonary abscess 78
Pulmonary emphysema 81
Pulmonary thromboembolism 73, 82-83
Pyelonephritis 151-152, 154
Pyometra 171-173
- Rabies 146-147
Ragwort poisoning 211

- Gastrocnemius trauma 118-119
 Gastrointestinal parasitism 54-55
 Gid 146
 Gingivitis 59
 Glaucoma 133
 Goitre 28
 Gonitis 114, 116
 Grass staggers 140
 Grass tetany 140
- Haemangiosarcoma 210
Haematobia irritans 36, 40
 Haematoma 42, 158
Haematopinus eurytenuis 34
Haemonchus placei 54
Haemophilus 75, 144-145
 Haemorrhage
 carpus 47
 sclera 134
 Harelip 7
 Head flies 40, 177
 Heartwater 199
 Heel
 abscess 93
 Elso 120
 erosion 100, 103
 Helminths 36-37
 Hepatic *see also* Liver
 abscessation 73, 82
 diseases 70-71
 necrosis 194
 Hepatitis 72, 212
 Hernia
 flank 44
 inguinal 159
 scrotal 160
 umbilical 19, 20
 Herpes mammillitis 181
 Hip
 dislocation 108
 dysplasia 120
 Hock trauma 117-119
 Hoflund syndrome 65
 Hoof wall disorders 101-103
 Horn, ingrowing 46
 Horn flies 36, 40
 Hump sore 36
 Husk 80-81
 Hyaena disease 125
Hyalomma truncatum 200
 Hydrallantois 45
 Hydranencephaly 10
 Hydrocephalus 10
 Hydrops allantois 167
 Hydrops amnii 167
 Hydrosalpinx 166
Hydrotea irritans 40, 177
 Hygromata 117-118, 121
 Hyperkeratosis 36, 184
 Hyphaema 135
 Hypocalcaemia 106, 118, 140, 174
 Hypocuprosis 31, 126-127, 217
Hypoderma 40-41
- Hypomagnesaemia 140
 Hypopyon 133, 144
 Hypospadias 12
 Hypotrichosis 14
- Imperforate hymen 163-164
 Impetigo, udder 186
 Infections
 bacterial 21, 142-145
 parafilarial 37
 protozoal 195-202
 ricketsial 195-202
 viral 7, 21, 146-147
 Infectious arthritis 115-116
 Infectious bovine keratoconjunctivitis (IBK) 40, 132-133
 Infectious bovine rhinotracheitis 75-76, 159
 Infectious ophthalmia 132-133
 Infectious pustular vulvovaginitis 76
 Infectious septic thrombomeningo-encephalomyelitis 144-145
 Infectious thromboembolic meningoencephalitis 144-145
 Infertility 176
 Infestations
 fly 40-42
 tick 195
 Infiltrative lymphosarcoma 66
 Ingrowing horn 46
 Inguinal hernia 159
 Inhalation pneumonia 82
 Interdigital conditions 96-101
 Intersexuality 163
 Intestinal obstruction 13
 Intussusception 69
 Iodine deficiency goitre 28
 Iridocyclitis 136, 193
 Iritis 136
 Ischaemic muscle necrosis 106, 108, 119
- Jejunum 13, 69-70
 Jembrana disease 202
 Johne's disease 53
 Joint disease, degenerative 113
 Joint ill 28
 Joint laxity, congenital 9
- Kale 211
 Keratitis 132, 134
 Keratoconjunctivitis 193
 Ketosis 141
 Kidney stones 152-154
 Kyphosis 11, 109-110
- Laminitis 62, 89, 104-105
 septic 92
 sole overgrowth 103
 sole ulcer 95
Lantana poisoning 31, 212
 Laryngeal diphtheria 27
 Lead toxicity 216
- Leptospira*
 hardjo 175
 interrogans 152
 Leptospirosis 152
 Lethal trait A46 14
 Leukosis 206-208
 Lice 34, 39
 Lightning stroke 149
Linognathus vituli 34
 Lipomatosis 73
Listeria 136, 144
 monocytogenes 142
 Listeriosis 142
 Liver *see also* Hepatic, Hepatitis
 diseases 70-71
 fatty liver syndrome 141
 lupine toxicity 214
 necrosis 194
 photosensitisation 30
 ragwort toxicity 211
 Lockjaw 205
 Locoweed 213
 Lumpy jaw 56, 58
 Lumpy-skin disease 194
 Lungworm infection 80-81
 Lupine toxicity 214
 Luteal cyst 165
 Lymph nodes, parotid 60
 Lymphadenopathy 193
 Lymphangitis, ulcerative 39
 Lymphoma, abomasal 67
 Lymphosarcoma 206-207
 infiltrative 66
 ocular 137
- Mad itch 147
 Magnesium deficiency 140
 Malignant catarrhal fever 193
 Malignant oedema 59
 Mandibular fracture 56
 Manganese deficiency 127
 Mange 32-34
 Marasmus, enzootic 128
 Mastitis 106, 177-181
Mecistocirrus digitatus 54
 Megaoesophagus 61
 Meningitis 143-144
 Meningocoele 8
 Meningoencephalitis 142, 147
 Metabolic diseases 106, 139-141
 Metacarpal fractures 114-115
 Metatarsus 123
 Metritis 106, 171-173
 Microphthalmia 129
Microsporium 35
 Milk fever 106, 140
 Milking machine trauma 184
 Mineral deficiencies 7
 Molybdenum toxicosis 217
Moraxella bovis 40, 132
Mucor 176
 Mud fever 100
 Mule foot 13

- Cheilognathoschisis 7
Chlamydia 75
psittaci 200
Chorioptes bovis 33
Chorioptic mange 33
Chrysomya bezziana 42
Circling disease 142
Cirrhosis 194
Claviceps purpurea 124
Claws 102-103
Cleft lip 7
Cleft palate 7, 11
Clostridial diseases 21-22, 204-206
Clostridium
botulinum 205-206
chauwoei 204
haemolyticum 70, 72-73
novyi 70, 72-73
oedematiens 70
septicum 59
tetani 205
welchii 21-22
Cobalt deficiency 128
Coccidiosis 25
Coccyx, hypoplastic 12
Cochliomyia hominivorax 42
Coenurus cerebralis 146
Coloboma 130
Congenital joint laxity and dwarfism (CJLD) 9
Congestive cardiac failure 83, 85-87
Conjunctivitis 76, 132-134
Contagious bovine pleuropneumonia 75, 79-80
Copper deficiency 31, 126-127, 217
Copper toxicosis 217
Corkscrew claw 102
Corkscrew penis 157
Cornea 131-132
Coronary band abscess 92
Coronavirus 21
Corynebacterium
bovis 179
renale 151-152
Cowdriosis 199
Cowpox 181, 183
Cranial cruciate ligament rupture 114
Crooked calf disease 214
Cryptorchidism 156
Cryptosporidia 21
Cystitis 155

Deep flexor tendon rupture 94, 96
Deficiency diseases 28, 125-128
Degenerative joint disease 113
Demodex 32
Demodectic mange 34
Dental problems 55-56
Dermatitis
digital 98-99
necrotic 187
photosensitive 16, 30, 214-215
stephanofilarial 36

Dermatobia hominis 41
Dermatophilosis 38
Dermatophilus 100
congolensis 38
Dermatophytosis 35
Dictyocaulus viviparus 80
Digestive scour 25
Diphtheria 27
Diphtheritic enteritis 23
Double cervix 164
Downer cow syndrome 106-109
Drenching gun injury 60-61
Dwarfism 9
Dystocia 167-169
downer cow syndrome 106, 109
hydrops allantois 167
metacarpal fractures 114
obturator paralysis 109
sacroiliac subluxation 111
schistosomus reflexus 10
scleral haemorrhage 134
uterine prolapse 174

Ear
gangrene 124
infections 36, 142
necrosis 23, 45, 202
tag infection 45
East Coast fever (ECF) 198
Eczema
facial 31, 214-215
teat 185
Ehrlichiosis 201
Eimeria 25
Electrocution 150
Elso heel 120
Endemic calf pneumonia 78
Endocarditis 86
Endometritis 171-173, 176
Endophthalmitis 133
Enteque seco 212
Enterotoxaemia 22
Entreva 126
Enzootic bovine adenomatosis 81
Enzootic bovine leukosis 208
Enzootic calcinosis 212
Enzootic calf pneumonia 78
Enzootic marasmus 128
Ephemeral fever 194
Epiphora 132
Epiphysis 115
Episiotomy 169
Epitheliogenesis imperfecta 13
Ergot gangrene 124
Erythropoietic porphyria 16
Escherichia coli 18, 21, 162, 178, 180
Espichamento 212
Exophthalmos 130
enzootic bovine leukosis 208
lymphosarcoma 137
Eyeball, prolapse 135
Eyelids 135-137

Face flies 40
Facial eczema 31, 214-215
Facial nerve paralysis 142
Faecolith 47
False sole 90
Fasciola hepatica 71, 73
Fascioliasis 70-71, 73
Fat cow syndrome 141
Fat necrosis, abdominal 73
Fatty liver syndrome 141
Femoral fracture 108, 113
Femoral paralysis 119
Fescue foot gangrene 124
Fetlock, septic arthritis 116
Fibroma 97-98
Fibromyoma, uterine 167
Fibropapillomas 39, 157, 183
Fissures
hoof wall 101-102
teat 184
Fistulas 20, 170
Flank hernia 44
Flexor tendon rupture 94, 96
Flies 36-37, 39, 40-42, 203
Flukes 71-72
Fluorosis 55, 104, 217
Foetus, mummified 175
Fog fever 81
Follicular mange 34
Foot-and-mouth disease 189-190
Footrot 96-97
Foreign bodies
heart failure 87
interdigital 101
metatarsus 123
ocular 134
penetration of axial wall 92
penetration of sole 91
Forestomach obstructive syndrome 65
Foul 96-97
Fractures
cervical spine 111
distal phalanx 104 f
emur 108, 113
iliac shaft 112
mandibular 56
metacarpal 114-115
pelvic 112
penis 158
pubic 112
sacrococcygeal 112
vertebral 109
Freemartinism 163
Frostbite 45, 162
Fungal toxins 214-125
Fusobacteria 62
Fusobacterium necrophorum 27, 73, 96, 172, 184

Gall sickness 197-198
Gangrene 23, 123-124, 161
Gangrenous mastitis 179-180

INDEX

Figures refer to page numbers

- Abdominal fat necrosis 73
Abdominal pain 63
Abomasum
 displaced 67-68
 lymphoma 67
 obstruction 65
 torsion 68
 ulceration 24, 66
 worms 54-55
Abortion 175-176
 leptospirosis 152
 listeriosis 142
 Rift Valley fever 194
Abscesses
 brain 143
 coronary band 92
 heel 93
 hepatic 73, 82
 infected haematoma 43
 popliteal 122
 preputial 158
 pulmonary 78
 retropharyngeal 61
 skin 44
 sole 92
 submandibular 60
 umbilical 19, 20
 vertebral 110
 white line 90-91
Acetonaemia 141
Acidosis 62, 89, 96, 104
Acorn toxicity 210
Actinobacillosis 56-57
Actinobacillus lignieresi 57
Actinomyces 73, 180
 bovis 58
 (*Corynebacterium*)
 pseudotuberculosis 39
 (*Corynebacterium*)
 pyogenes 172, 177, 180
 pyogenes 18, 56, 59-60, 110, 116,
 122, 160, 162
Actinomycosis 56, 58
Acute respiratory distress
 syndrome 81
Adema disease 14
Adenomatosis, enzootic bovine 81
Adhesions 70, 166
Akabane virus 10, 11
Alopecia 26
 baldy calf syndrome 14
 cutaneous stephanofilariasis 36
 navel ill 18
 ringworm 35
Altitude sickness 83
Alveolar periostitis 59
Amblyomma 195
Amyloidosis 154
Amyotonia, pectoral 11
Anaplasmosis 197-198
Anasarca 9, 168
Angioneurotic oedema 29
Ankylosis 111
Anophthalmia 129
Anthrax 203
Anus
 congenital absence 12
 oedema 74
Aphosphorosis *see* Phosphorus
 deficiency
Arthritis
 calf 28
 hip 113
 infectious 115-116
 septic pedal 93-94
Arthrogryposis 8, 10-11
Ascites 70-71
Aspergillus 62, 176
Aspiration pneumonia 82
Atresia ani 12
Atypical interstitial pneumonia 81
Atypical mycotuberculosis 39
Aujeszky's disease 147
Babesiosis 196-197
Bacillary haemoglobinuria 72
Bacillus anthracis 203
Bacterial diseases 203-206
Bacterial endocarditis 86
Bacterial infections 21, 142-145
Bacteroides 98
 melaninogenicus 59
 nodosus 99, 100
Balanoposthitis 76, 159
Baldy calf syndrome 14
Bali disease 202
Bee stings 29
Besnoitiosis 37
Black disease 72
Black spot 184
Blackleg 204
Bladder
 neoplasia 210
 rupture 153-154
Blaine 29
Blepharospasm 132
Blind quarter 179
Blindness 130-131, 145, 216
Bloat 25, 63, 140
Blood flukes 72
Blowflies 42
Bluetongue 192
Bones, ingestion 126
Botulism 126, 205-206
Bovicola bovis 34
Bovine herpes mammillitis 181
Bovine iritis 136
Bovine leukosis 206-208
Bovine lymphosarcoma 206-207
Bovine malignant catarrh 193
Bovine papular stomatitis 52, 181
Bovine petechial fever 201
Bovine pulmonary emphysema 81
Bovine spongiform
 encephalopathy 148
Bovine virus diarrhoea/mucosal
 disease (BVD/MD) 49-51, 66,
 129-130
Brachial plexus injury 120
Bracken fern toxicity 39, 135,
 209-210
Brain abscess 143
Brisket disease 83
Bronchitis, verminous 80-81
Bronchopneumonia, suppurative 145
Brown coat colour 31, 126
Brucella abortus 116, 160, 162, 176
Brucellosis 121, 176
Buffalo flies 40
Bulldog calf 8-10
Bursal adhesions 166
Bursitis
 neck 43
 tarsal 117
Buss disease 200
Caecal torsion 68
Calcinosis, enzootic 212
Calcium deficiency 125
Calf scour 21-23
Calfhood multicentric
 lymphosarcoma 206
Campylobacter 25
Cara inchada 59
Carbamate toxicity 216
Carpal hygroma 117, 121
Carpitis, septic 115
Castration 161
Cataracts 129-131
Catarrhal fever 193
Cattle plague 191-192
Caudal vena caval thrombosis 82-83
Cellulitis
 necrotic 59
 septic 60, 92
 tarsal 117
Cerebellar hypoplasia 49
Cerebrocortical necrosis 139
Cervical prolapse 174
Cervical polyp 174
Cervix, double 164

Contents

Foreword – <i>D.C. Blood</i>	4
Preface	4
Acknowledgements	5
1 Congenital disorders	7
2 Neonatal disorders	17
3 Integumentary disorders	29
4 Alimentary disorders	49
5 Respiratory disorders	75
6 Cardiovascular disorders	85
7 Locomotor disorders	89
Lower limb and digit	89
Upper limb and spine	106
8 Ocular disorders	129
9 Nervous disorders	139
10 Urinogenital disorders	151
Urinary tract	151
Male genitalia	155
Female genitalia	162
11 Udder and teat disorders	177
12 Infectious diseases	189
13 Toxicological disorders	209
Index	218

Vegetative endocarditis 86
Ventral abdominal oedema 188
Ventral serrate muscle, rupture 122
Ventricular septal defect 8, 15
Verminous bronchitis 80-81
Vertebrae
 abscesses 110
 fusion 11
 osteomyelitis 110
Vesicular stomatitis 52, 183
Viral diseases 49-53, 189-195
Viral infections 7, 21, 146-147
Vitamin A deficiency blindness
 130-131

Vitamin D deficiency 118, 125
Vitamin E deficiency 123
Vulval discharges 171-173
Vulvitis, septic 170-171

Wall eye 130
Warble fly 40-41
Warts 39, 157, 183
White heifer disease 163-164
White line abscess 90-91
White line impaction 89
White muscle disease 123
White scour 22
Winter diarrhoea 53

Winter dysentery 53
Wooden tongue 56-57
Worms
 abomasal 54-55
 canine tapeworm 146
 lung 80-81
 screw-worm 42

Yew poisoning 211

Zinc deficiency 14

febrile and develop anal sphincter spasm, producing 'coiling' of faeces which are voided under pressure (660). *Ixodes ricinus* is the vector for *Babesia bigemina*. Disease caused by babesiosis is distributed worldwide wherever there are ticks. *Differential diagnosis* (of redwater): includes anaplasmosis (661), bracken poisoning (700), kale poisoning (707), bacillary haemoglobinuria and nitrate poisoning (724).



660

Anaplasmosis ('gall sickness')

Caused by the rickettsia, *Anaplasma marginale*, gall sickness is endemic in tropical and subtropical regions of Africa, Australia and the Americas. Transmission is by ticks (*Boophilus* and *Dermacentor species*), biting flies, or iatrogenically, for example, during mass

vaccination. Adult cattle are more severely affected. After initial pyrexia and anorexia, anaemia develops, as shown on the vaginal mucosa in 661, and later jaundice (662). Mortality may reach 50%.

661



662



Babesiosis ('redwater fever')

655



656



657



658



The term 'redwater' originates from the haemoglobinuria that is seen following a haemolytic anaemia produced by protozoa of *Babesia* species, *B. bovis* and *B. divergens* being the most important. They may occur singly or together, and in combination with *Anaplasma* to produce fatal 'tick fever'. The South Devon cow in 655 has lost condition. She has a dejected appearance, with drooping ears, half-closed eyes and the front legs abducted to maintain balance. Her flank is hollow, indicating lack of rumen fill. There is extreme pallor of the vulval membranes (656) and the conjunctiva is both anaemic and jaundiced (657). Dark, port wine coloured urine, as seen in the South Devon steer in 658, often produces a characteristic golden yellow froth as it hits the ground (659). Affected cattle are

659



Tick-borne diseases (protozoal and rickettsial infections)

In tropical Africa, ticks are very important owing to their impact on the cattle industry. Tick infestations depress productivity as a direct result of their feeding activity. This is primarily through reduced liveweight gain, and other consequences including anaemia, skin wounds that are susceptible to secondary bacterial infection or screw-worm infestation (110), and toxic reactions to tick saliva (e.g., sweating sickness, 670 & 671). Indirectly however, they have a far more significant role as vectors of diseases such as East Coast fever (ECF) and theileriosis throughout East and

Southern Africa, where they cause the death of half a million cattle each year in the endemic areas.

Other tick-borne diseases that limit cattle production in Africa and elsewhere include babesiosis, anaplasmosis, heartwater (cowdriosis) and streptothricosis. Ticks parasitic on cattle can be divided into two families, the Ixodidae or 'hard' ticks and the Argasidae or 'soft' ticks, depending on the presence or absence of a hard, dorsal scutum. These families also have many other differences.

Tick infestations

652



Taken in Antigua, West Indies, 652 shows *Amblyomma variegatum* ticks feeding on teats. These species are mainly found in the tropics and subtropics, causing disease both directly and by parasite transmission. Mixed tick infestations do occur. Their large mouthparts can cause serious wounds that are liable to secondary infection. The scrotum is also a common region for tick feeding. In 653 *Amblyomma* species (bont ticks) are seen in varying stages of engorgement, feeding around the perineum and anus of a four-month-old Friesian heifer from Zimbabwe. White larvae along the edge of the tail indicate early myiasis

653



654



lesions. These changes are more pronounced in 654, where tick damage has resulted in an enlarged vulva, with raw, bleeding areas. Early myiasis is again visible. Myiasis lesions are also shown in 110 and 111.

Lumpy-skin disease

An infectious disease that is limited to Africa, lumpy-skin disease produces nodules on the skin and elsewhere, which may become secondarily infected. The nodules (648) are discrete, firm, raised and painful masses involving the skin, as well as the gastrointestinal, respiratory and genital tracts (orchitis), and the conjunctiva. The nodules contain firm, grey-yellow material. The regional lymph nodes are enlarged (prescapular in 648). There are two distinct diseases, one of which is caused by the 'Neethling' poxvirus, while the milder form is due to infection with the 'Allerton' herpesvirus. *Differential diagnosis:* ulcerative lymphangitis (pseudotuberculosis) (102), pseudo-lumpy-skin disease and streptothricosis (dermatophilosis) (97).



64

Rift Valley fever

Rift Valley fever (RVF) is confined to Africa, with epizootics occurring in southern and central Africa, and more recently in Egypt. It is an acute febrile disease that is communicable to humans. The cause is a phlebovirus (Bunyaviridae). Affected calves usually die after a short illness, but abortion is the main clinical sign in adult cattle, which have a lower mortality rate. The characteristic postmortem lesion (649) is extensive hepatic necrosis, seen in this section of an experimental infection. Diagnosis rests on laboratory serological testing. In the absence of a vaccine, control depends on strict prohibition of the importation of susceptible cattle from endemic parts of the African continent. *Differential diagnosis:* bluetongue (641) and rinderpest (634).



64

Ephemeral fever ('three-day sickness')

Severe cases of ephemeral fever are initially seen in sternal recumbency and later in lateral recumbency (650) with signs of flaccid paralysis. Other features include rumen atony, loss of the swallow reflex and tongue tonus (651), and partial paralysis of the lower jaw, resembling botulism. Mild cases are pyrexemic, stiff

and only slightly ill. The disease occurs in Africa, Asia and Australia, and is caused by an insect-borne (e.g., sandfly) rhabdovirus. Other signs include fever, muscle stiffness, lameness, atypical interstitial pneumonia, and lymphadenopathy. *Differential diagnosis:* botulism (687), severe toxæmia, physical injury.

650



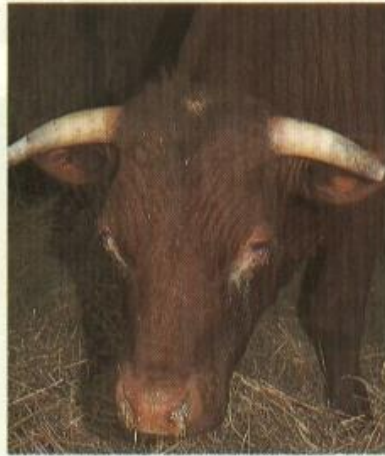
651

Malignant catarrhal fever (MCF, bovine malignant catarrh, malignant head catarrh)

Malignant catarrhal fever causes a severe pyrexia with catarrhal and mucopurulent inflammation of the upper respiratory and alimentary epithelia, keratoconjunctivitis following a characteristic initial peripheral keratitis, and lymphadenopathy. MCF outbreaks occur predominantly in Africa. Elsewhere (North America and Europe), single individuals tend to show signs. The 'head and eye' syndrome of the Devon cow in 644 includes a purulent oculonasal discharge, mild keratitis, and hyperaemia of the nostrils. After a few

days, dried material becomes caked on the nostrils (645). The peripheral keratitis is demonstrated in 646. Iridocyclitis may lead to photophobia. Areas of haemorrhagic necrosis and ulceration (647) are particularly prominent in the oral and nasal cavities (A). MCF is almost invariably fatal and no vaccine regime is currently available. Clinical cases should be isolated. *Differential diagnosis:* rinderpest (634), bluetongue (641), East Coast fever (665), IBR (222), BVD/MD (130) and bovine iritis (443).

644



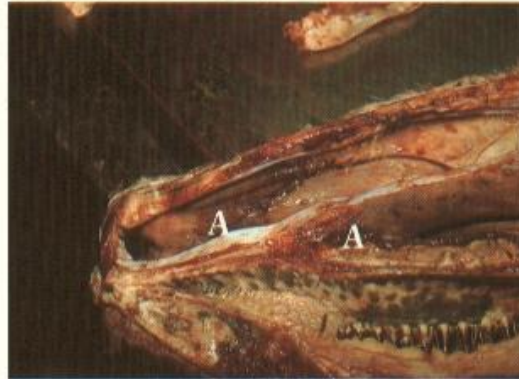
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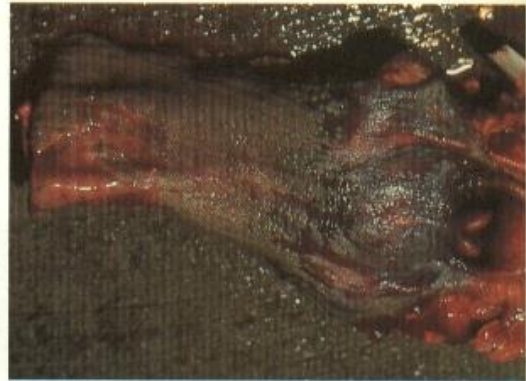
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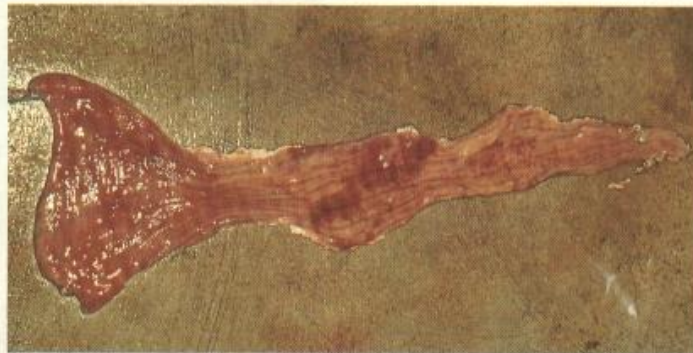
647



the entire length of the alimentary tract, from the hard palate to the pharynx and oesophagus (639), and the typical zebra-striped rectum in 640, leading to severe diarrhoea and death from dehydration. Lesions are indistinguishable clinically from BVD (132), and other differential diagnoses include IBR (222) and malignant catarrhal fever (644). The illustrations are from Saudi Arabia, Yemen and Nigeria.



63



640

Bluetongue

Bluetongue causes initial hyperaemia of the muzzle and lips (641), followed by inflammatory and erosive lesions. Necrotic areas may be seen in the gums and the dental pad (642), and there may be irregular, superficial erosions on the teats (643). The disease is caused by an orbivirus and is transmitted by biting insects (*Culicoides*). While endemic on the African continent, blue-

tongue is sporadic in many other parts of the world. In North America it is a mild clinical condition and differential diagnosis is difficult. It has been mistaken for photosensitisation (71 & 72), BVD (132), IBR (223), vesicular stomatitis (141) and FMD (629). Mycotic stomatitis is also caused by the bluetongue virus.

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Rinderpest ('cattle plague')

Rinderpest is a very severe, contagious disease with a mortality of up to 100%, especially when outbreaks occur in previously free areas (634). It is endemic in parts of Africa, the Middle East and the Indian subcontinent. Multinational campaigns to eradicate rinderpest from West and Central Africa have failed in many cases, despite the initial successful use of an effective vaccine. Various factors have been to blame, including wars, a shortage of trained personnel, lack of refrigeration for storage of vaccines, and other organisational problems. Early recognition and notification of outbreaks of rinderpest are vital to any eradication campaign. The causal agent, a paramyxovirus, causes a severe oculonasal discharge, which may become purulent (eye 635, nares 636) with necrosis and diph-

theresis. An early oral sign, seen within 2-3 days of infection, is the formation of small, pinpoint areas of necrosis on the ventral (never the dorsal) surface of the tongue (637) which develop into plaques within 1-2 days. These are also seen on the gums and dental pad in 638. Necrotic and erosive lesions extend along



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In a steer infected experimentally two days previously, ulcers are seen along the lower gums and inside the lower lip, together with ruptured tongue vesicles (630). Two days later the lesions on the tongue, lower lip and gums have become secondarily infected (631). On the fifth day, vesicles on the coronary band and dorsal part of the interdigital space have ruptured (632),

and on the seventh (633) the interdigital space shows widespread ulceration along its entire length. Lameness may be the first sign of FMD. These interdigital lesions easily become secondarily infected. *Differential diagnosis:* includes vesicular stomatitis (141), BVD/MD (132), bovine papular stomatitis (143 & 144) and rinderpest (636).

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12 Infectious diseases

Introduction

Infectious diseases are a major limiting factor in cattle production in many parts of the world. In tropical Africa, with its 161 million cattle, the major diseases, i.e., rinderpest, foot-and-mouth disease, contagious bovine pleuropneumonia, theileriosis and trypanosomiasis, are all infectious. Such limitations on livestock production lead to shortages of meat, milk, draught

animals and manure, and to the necessity to import from developed countries such as North America and Australia, and the European Community. These imports in turn discourage domestic livestock production, while the presence of infectious diseases bars the export of cattle and cattle products to the developed countries.

Viral diseases

Several major bovine diseases, endemic in many parts of the world, have a viral aetiology. They are characterised by their highly contagious nature and the variety of their cloven-footed hosts. Early recogni-

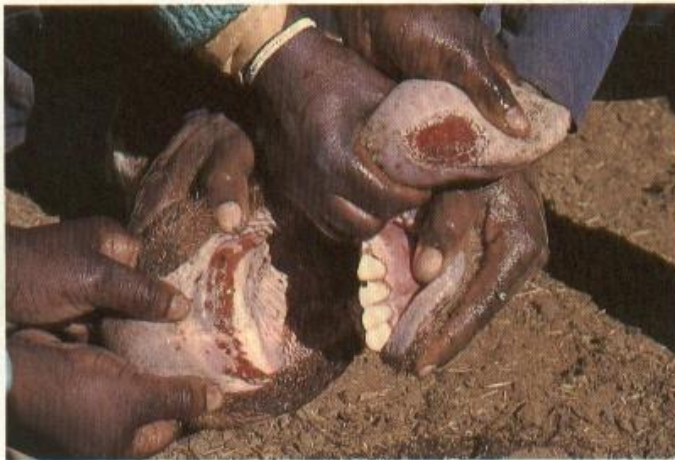
tion of suspicious signs and confirmation of the disease in the laboratory, together with prompt and effective control measures, are essential for their eradication.

Foot-and-mouth disease (FMD)

Cattle infected with foot-and-mouth disease are dull, off feed, and drool saliva. Some are lame. On opening the mouth (629), large areas of epithelial loss, that are

the result of recently ruptured FMD vesicles, are seen on the tongue and hard palate, as in this animal from Zimbabwe.

629



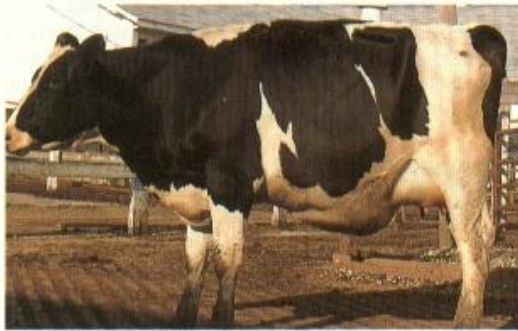
Ventral abdominal oedema

A physiological periparturient condition, extensive subcutaneous oedema is seen cranial to the udder of the Holstein heifer in 626, two days after calving. In advanced cases it may extend to the sternum.

Typically, oedema is demonstrated as 'pitting' when pressure is applied. Digital pressure on the rear

of an oedematous udder (627) creates a depression (seen to the left of the finger (A)) which persists for 30–60 seconds after the finger has been withdrawn. Overfeeding, an overfat prepartum condition, heredity and lack of exercise are among the factors contributing to excess oedema.

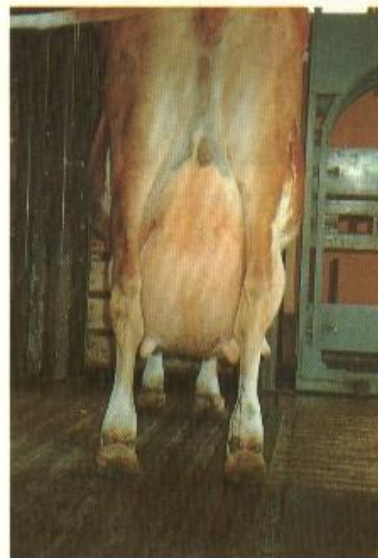
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627

Dropped udder (rupture of median suspensory apparatus)

The six-year-old Guernsey cow in 628 had calved four weeks previously, and had suddenly developed a grossly pendulous udder as a result of sudden rupture of the median suspensory apparatus (ligaments) of the udder. Note that the ventral udder surface is considerably below the level of the hock. The outward direction of the teats is a mechanical result of the loss of ligamentous support of the udder, which had no evidence of mastitis. Postmortem examination revealed a massive haematoma surrounding the ligamentous rupture between the ventral body wall and the gland parenchyma. Breeding and prepartum overfeeding that leads to excessive udder engorgement are predisposing factors. *Differential diagnosis:* acute mastitis, ventral abdominal rupture (prepubic tendon (121), or rectus abdominis muscle) and severe udder oedema (627).



628

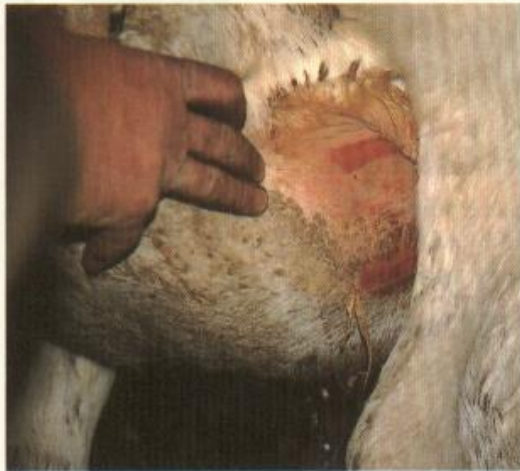
Necrotic dermatitis (udder seborrhoea)

This dermatitis occurs in the first 1–2 weeks after calving, especially in heifers, and is associated with excessive prepartum udder oedema, leading to skin ischaemia and necrosis. Mild cases (622) develop a moist and often foul-smelling superficial dermatitis laterally in the contact area between the udder and thigh. In more advanced cases (623) the ischaemic udder skin turns reddish-purple and produces a dirty, serous exudate, similar to some cases of acute or peracute mastitis (583). A dry, scaly dermatitis (624) may lead to extensive thickening of the teats, and

some animals become impossible to milk. Note the residual cutaneous oedema cranial to the udder in this heifer.

In mature cows the usual site of the dermatitis is the area of skin between the two forequarters and the ventral body wall. The lesion, which may persist for several weeks, is a deep, moist and exudative dermatitis with a pungent odour (625). Necrotic debris is seen in the centre. *Differential diagnosis*: severe udder impetigo (staphylococcal dermatitis) (621), bluetongue (643), bovine herpes mammillitis (597).

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Teat cistern granuloma ('pea')

Free-floating, irregular, rubbery masses of fibrocollagenous material ('peas') may develop in the teat cistern and pass down to the sphincter, thus obstructing the milk flow. As in **618**, some can be manually expressed from a surgically dilated teat orifice. Others

are attached to the teat mucosa and cannot be so easily removed. A variety of shapes, sizes and colours is found (**619**). All have a rubbery texture and are 5–10 mm long.

618



619

Supernumerary teats

Supernumerary teats are a congenital condition. They may be found between the front and rear teats, and/or attached to the udder behind the rear teats (**620**), or to the base or side of one of the main teats, where they can interfere with milking. Typically, they are shorter than normal teats, and have thinner walls. They may connect to the sinus of an existing teat, or, more commonly, have a separate supernumerary gland. As such teats are both unsightly and may develop mastitis, they are normally removed early in life, when extreme care is necessary to identify the correct teat.



620

Conditions of the udder skin and subcutis

Udder impetigo (udder acne)

Small, red papules are seen on the udder of the Friesian in **621**. They sometimes coalesce to produce an exudative dermatitis that can spread onto the teats and may develop a foul odour. A coagulase-positive staphylococcus was isolated in this case. Topical therapy is effective. *Differential diagnosis* (of advanced teat cases): bovine herpes mammillitis (**597**) and necrotic dermatitis (**622**).



621

Summer sores and teat eczema

Summer sores are eczematous lesions that result from excessive licking, and may be secondary to irritation caused by flies. First seen as irregular-shaped areas of moist, wet eczema at the teat base, they may spread to involve almost the entire teat (614), when they can be very painful. 614 shows islets of residual epithelium in the granulation tissue, especially towards the tip of the teat, and there is a serous exudate. At this stage, differential diagnosis from bovine herpes mammillitis (598) and necrotic dermatitis (622) is difficult. Simple sunburn producing a thickening of teat skin may also occur (71).



614

Teat trauma

Because of their position, teats are very prone to injury, especially in cows with turgid or pendulous udders. Barbed wire often produces multiple lacerations and may leave a horizontal flap of skin (615). This flap tends to be pulled downwards when the teat cups are removed at milking, thus retarding healing. Amputation of the skin flap promotes healing. Superficial epidermal abrasions (616) cause few problems, although

this teat had been injured in a previous lactation, leaving a fistula (A) of the cistern at its base. Trauma can cause complete loss of a large area of skin, but this often heals surprisingly well. Injuries such as a contaminated flap involving the teat sphincter, or localised ulceration (617), carry a high risk of both mastitis and stenosis of the orifice.

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Noninfectious teat conditions

Teat orifice lesions (hyperkeratosis, 'black spot', chaps and fissures)

Hyperkeratosis is initially seen as a raised, pale, bulbous swelling of the circular sphincter area, with small, protruding fragments of dry, keratinised material (608). Advanced cases, which predispose to mastitis, show severe keratinisation (609), which may precede black spot. Although associated with faulty milking machine function, other factors are also involved and the condition may occur spontaneously. Milking machine trauma produced the dry, circular, haemorrhagic areas on the teats in 610. Sphincter eversion is marked.

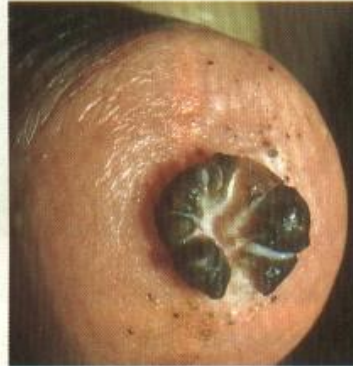
Black spot or black pox describes a proliferative necrotic dermatitis of the teat end around the sphincter, seen extending to the left in 611. Black necrotic

tissue is clearly visible. The lesion is caused by a range of environmental traumas (e.g., overmilking, excessive vacuum fluctuation, wet teats exposed to a chilling wind), leading to damage of the teat orifice, which may then become secondarily infected with *Fusobacterium necrophorum*. The skin fissure adjacent to the black spot lesion in 611 is a teat chap, which often results from repeated exposure to wet, cold winds or, sometimes, to irritant chemicals. It is not unusual for the whole teat to be affected (612). Severe skin fissures or teat chaps (613) can sometimes virtually obliterate the teat orifice. Topical emollients are important in prevention.

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Cowpox (vaccinia)

Caused by a pox virus closely related to smallpox in man, cowpox produces vesicles on the skin of the teats and the udder. **603** illustrates three teat skin vesicles which have ruptured, exposing the underlying granulation tissue. Cowpox is now extremely rare and the infection is limited to Western Europe.



603

Vesicular stomatitis

Vesicular stomatitis is caused by a rhabdovirus that is found only in North and South America and is transmitted by mosquitoes and biting flies. It primarily produces mouth lesions (**141**), but lesions can also occur on the teats and coronet. Multiple, irregular-shaped, white vesicles, some of which have ruptured, cover much of the teat skin in **604**. Recovered animals are immune for 12–18 months.



604

Fibropapillomas (warts)

Caused by different strains of papovaviruses, warts are common among groups of pregnant and first lactation heifers, typically over the lower part of the teat. Some have a 'feathery', keratinised and papilliform appearance (**605**) and can be easily pulled off. Others are more nodular (**606**) and tightly adherent to the skin. Mixed infections may occur (**607**). Fibropapillo-

mas close to the teat orifice and sphincter interfere with milking and predispose animals to teat stenosis and mastitis. Flies are considered to be important vectors for transmission. Autogenous vaccines are generally more effective than commercial. Warts also occur on the skin (**100**), eye (**450**) and penis (**510**).

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Pseudocowpox (paravaccinia)

Pseudocowpox is caused by a parapox virus and is a common infection in many parts of the world, spreading slowly within a herd. Both the teats (primarily) and the udder may be affected and 'milker's nodules' may occur on the fingers of man. An individual cow may remain clinically affected for several months and, as immunity is short-lived, repeated attacks can occur every 2-3 years. The disease starts as a small, painless papule affecting the superficial layers of the skin (599). After 7-10 days the lesion enlarges from the

periphery to produce characteristic circular or horse-shoe-shaped areas, delineated by small, red scabs (600). The affected area feels rough, but is not painful, and milking is not usually impeded. Scabs slowly resolve in the healing phase (601). In rare cases, the lesion develops a very rough, slightly moist, papilliform appearance, with several elevated and confluent masses (602). *Differential diagnosis:* bluetongue (641), cowpox (603), and vesicular stomatitis (604).

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Infectious teat conditions

Teats are affected by two pox viruses, pseudocowpox (paravaccinia), a mild infection that occurs throughout the world, and cowpox (vaccinia), which is now extremely rare. Both are transmissible to man. The parapoxvirus of pseudocowpox is related to bovine papular stomatitis (143 & 144). Bovine herpes mammillitis is a much more severe infection and may be confused clinically with the teat changes associated with necrotic dermatitis (udder seborrhoea). Other viral infections producing teat lesions include vesic-

ular stomatitis (604), fibropapillomas (605–607), bluetongue (643), foot and mouth disease (629) and rinderpest (634). Teats are also subject to physical injury, chapping and eczema often exacerbated by cold, wet conditions, twice daily milking and poor milking machine function. Examples include hyperkeratosis and 'black spot' of the teat sphincter (608), summer (licking) sores (614), trauma, and photosensitisation (72).

Bovine herpes mammillitis

Bovine herpes mammillitis (BHM) is a viral infection that initially produces fluid-filled vesicles, seen in the centre and towards the tip of the teat in 597. The overlying epithelium is stretched and white. Rupture of the initial vesicles exposes raw, ulcerated areas (seen between the two vesicles in 597), which later become covered by thick, brown scabs (598). Note the involvement of three teats and the extension of the le-

sions onto the udder skin. The condition is so painful that it is often impossible to milk affected cows (compare pseudocowpox, 599–602). BHM tends to occur in outbreaks and secondary mastitis is a major problem. Lifelong immunity follows recovery. *Differential diagnosis:* necrotic dermatitis (622–625) and bluetongue (643).

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Mastitic changes in milk

Milk is thicker and more viscous during the dry period and immediately postpartum (i.e., colostrum). Its character also changes in mastitis. Although specific types of mastitic infection frequently lead to similar

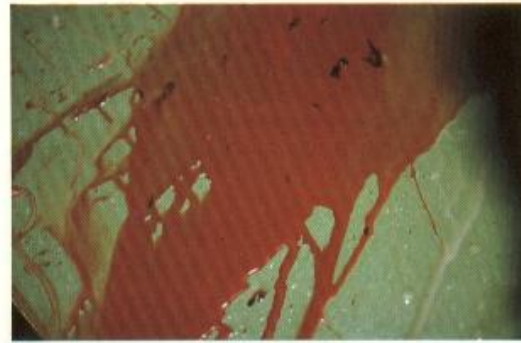
changes in milk, the appearance of the milk is *not* pathognomonic, and bacteriological examination is required to confirm the causative organism and to determine the antibiotic sensitivity.

Blood in milk

True blood clots are the characteristic feature of blood in milk. They may be present in slightly pink-tinged milk (591) or, in more severe cases, in a secretion that is almost totally red (592). Seen only in newly-calved

cows, or after trauma, the condition usually resolves spontaneously. No treatment has been found to be consistently useful. Herd outbreaks of unknown aetiology may occur.

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Mastitic milk

Watery, translucent milk with occasional clots (593) is typical of a mild mastitis such as that caused by *Strep-tococcus agalactiae* or *Strep. dysgalactiae*. Normal milk may be totally absent in severe staphylococcal (594) or *Actinomyces (Corynebacterium) pyogenes* infections, when the secretion consists of thick clots suspended in a clear, serous fluid. Summer mastitis (*Actinomyc-*

es) invariably produces a thick secretion with a characteristic pungent odour.

A brownish, serum-coloured secretion is typical of *Escherichia coli* infection (595), while acute gangrenous mastitis (e.g., acute staphylococcal) may produce a red or brown homogenous secretion (596), often mixed with gas.

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Advanced gangrene (587) leads to cold, damp teat skin. Although mastitis was limited to the right hind quarter (A), the entire udder was blue, oedematous, and cold to the touch. Adjacent to the affected teat is a skin slough and red exudate. The secretion from the udder was a deep port-wine colour and was mixed with gas. The cow had been normal when milked 12 hours previously, indicating the sudden onset of disease. In cases of



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nonfatal, gangrenous mastitis the overlying skin (588), or even the entire affected quarter, sloughs in a process which may take 1–2 months.

Chronic mastitis and blind quarter

Streptococcus agalactiae, *Strep. dysgalactiae*, staphylococci, *Corynebacterium bovis* and other bacteria can produce a chronic mastitis, manifested as 'clots' in the milk (593), with or without palpable udder changes.

Carrier cows act as a reservoir of infection and bacteria are transmitted to other quarters or other cows during milking. Hygiene, teat disinfection, correct milking machine function, dry cow antibiotic therapy and culling are important control measures. The Friesian cow in 589 shows large, hard nodules protruding from the udder, with two from the right quarter and one from the left. These are chronic, intramammary, staphylococcal abscesses. Staphylococci were cultured from the milk, which had a high cell count and gave a strongly positive

reaction to the California mastitis test. Such advanced cases, which are usually unresponsive to treatment, are dangerous carriers and should be culled. The Friesian cow in 590 had a blind quarter, having had mastitis in the previous lactation. The front left teat is slightly smaller than the others, and the associated quarter has totally atrophied. Blind quarters in heifers with nonpatent teats can be either congenital (total absence of the teat canal or persistence of membrane between the cistern and canal at the teat base), or acquired, e.g., undetected summer mastitis, when a thickened central core is palpable in the teat canal, or trauma from being suckled as a calf (39).

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Acute mastitis

Peracute and acute mastitis are most commonly seen in the first few weeks after calving, although cases can occur throughout lactation. In most cases, peracute mastitis results from coliform or staphylococcal infections. Similarly, in acute mastitis, environmental organisms such as coliforms (e.g., *Escherichia coli*) or *Streptococcus uberis* are frequently involved. Infection enters the teat and the udder between milkings. Acute disease may occasionally be caused by 'contagious' mastitis organisms such as staphylococci, which are carried on the skin or in the udder of affected cows and transmitted to other cows during milking.

The most prominent sign of acute mastitis is an enlarged, hard, hot and painful quarter. This may be apparent before any changes are visible in the milk. In some cases, a brown serous discharge may be seen on the surface of the affected quarter and teat, as in the lactating Friesian cow in 583. In a section of an

affected udder (584), deep red inflammation of the teat cistern and teat canal mucosa is seen. There is prominent subcutaneous oedema and the skin at the tip of the teat is congested. Changes of this nature can lead to gangrene. The yellow foci (A) in the udder parenchyma are pockets of pus. In 585 the teat skin, which was still warm and soft, and the affected quarter, are encircled by a ring of black gangrene, with red erythema at the periphery. The cow was severely ill with an eventually fatal toxæmia.

Such cases should not be confused with udder bruising (586). In this cow the forequarter is obviously enlarged, the front teat deviates medially, and a blue discolouration is seen on the lower half of both quarters. The cow was, however, bright and alert, there were no visible changes in the milk, and the skin remained warm.

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11 Udder and teat disorders

Introduction

The dairy cow is bred and fed to produce large volumes of milk. With the metabolic stress of high performance and the physical effects of being milked and handled two or three times daily, it is not surprising that the udder and teats are subject to a wide variety of disorders. The primary disease, mastitis, is of world-wide economic importance and much money is spent on its prevention, treatment and control. The first part of the chapter deals with mastitis in lactating and dry cows, and describes changes that may be seen in milk. The second part illustrates teat lesions, including a wide variety of viral infections, notably bovine herpes

mammillitis, cowpox and pseudocowpox, vesicular stomatitis and fibropapillomas (warts). Other systemic diseases that also affects the teats, for example, foot-and-mouth disease, are mentioned elsewhere.

Because of their anatomical position, especially in cows with pendulous udders, teats are vulnerable to injuries, eczema and other physical influences. These problems are considered in the third part, although changes associated with photosensitisation are covered elsewhere (72). The final part of the chapter includes miscellaneous conditions of the udder.

Summer mastitis

Summer mastitis is an endemic form of suppurative mastitis that typically occurs sporadically in dry cows and heifers in mid-late summer. It may also arise atypically from a teat sphincter injury in a lactating cow. Mild cases become only slightly ill, whilst the more severely affected cows are dull, pyrexial and anorexic. They may abort, or produce weakly calves at term. Acute, untreated cases may die. Very few quarters recover, although cases are very occasionally mild enough to pass unrecognised until calving, when the affected quarter is nonfunctional ('blind') (see also 590) and the teat is palpably thickened.

The Charolais heifer in 581 is an early case, showing distension of the left hind quarter, which was typi-

cally hard and sore, with a prominent, turgid teat. Several bacteria are involved, including *Actinomyces (Corynebacterium) pyogenes*, *Peptococcus indolicus*, *Streptococcus dysgalactiae* and a micrococcus which contributes to the typical odour. Infection is thought to be transmitted by the head fly *Hydrotoea irritans*. In more advanced cases, the infection may burst through the udder, as shown in the right hind quarter in 582. A thickening of the central teat canal was palpable, the quarter was very hard, and yellow pus with a pungent odour was discharging from the teat and udder. Control of summer mastitis includes dry cow therapy with long-acting intramammary antibiotics, fly repellents, and keeping cattle away from known fly areas.

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Brucellosis (contagious abortion)

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Brucellosis is a bacterial infection caused by *Brucella abortus*. Susceptible cattle ingest material from an infected foetus, placenta or uterine discharge and typically abort between seven and eight months of gestation. A marked placentitis may occur, which is seen as small, white, necrotic foci on the cotyledons and thickening of the intercotyledonary placenta (578). Most cows only abort once, although they may remain persistent carriers and excrete *Brucella* at subsequent normal parturitions. Retained placenta, endometritis and infertility are common complications. In the bull, the testicles (524) and seminal vesicles may be affected, although infection is only rarely present in the semen. Brucellosis is transmissible to humans, and is a notifiable disease in many countries.

Mycotic abortion

The mouldy silage in 579 was fed to twenty cows in late pregnancy. Haematogenous spread, leading to foetal infection, produced three abortions in ten days. *Aspergillus* was isolated from the foetuses. In some

cases, small, circular, ringworm-like lesions (580) are seen on the foetal skin. There may also be a pronounced thickening of the placenta and necrosis of the cotyledons. *Mucor* species may also be involved.

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Abortion and premature parturition

Abortion has been defined as the premature expulsion of the products of conception, typically producing a dead calf. Premature calving occurs late in gestation, to give a live but weak calf. Both phenomena may have similar infectious and noninfectious causes. Possible infectious factors include brucellosis, IBR, BVD, leptospirosis, *Campylobacter*, bluetongue, listeriosis, *Chlamydia*, *Coxiella* and aspergillosis. Noninfectious factors include stress, lethal genes (e.g., arthrogryposis), poisons (e.g., locoweed (716) and mycotoxins), nutritional deficiencies (e.g., vitamin E, selenium or iodine (67)) and physical injuries. The appearance of an aborted foetus (the foetus in 575 was aborted at seven months of gestation) may give little indication of the cause. Specific diagnostic tests are necessary, but despite careful investigation, the cause of abortion is found in less than 25% of all cases.



575

Premature calf

In addition to a reduced body size, the premature (seven months) Simmental crossbred calf in 576 shows hyperaemia (reddening) of the mouth and nostrils, soft hooves and a short, 'staring' coat. Most causes of abortion mentioned previously can also produce premature births. In this case, leptospirosis was the most probable. The dam had a titre of 1:1600 to *Leptospira hardjo*.



576

Mummified foetus

The foetus in 577 died at approximately four months of gestation, but was not expelled until eight months. Note the sunken eye sockets and the characteristic dry, chocolate-brown colour of the decomposing foetus and placenta. BVD is one cause of mummification. Certain bulls, especially Jerseys, may genetically produce an increased incidence of mummified foetuses.



577

Cervical prolapse

Cervical prolapse is similar in aetiology to vaginal prolapse. Small portions of the external os of the cervix may protrude through the vulva in cows in late pregnancy or early lactation (570), often disappearing when they stand. A more advanced case is shown in the post-partum Shorthorn cow in 571. The external os is oedematous and grossly distended. A short

length of vaginal wall is exposed between the cervix and vulva. Complete cervicovaginal prolapse may occur. A cervical polyp (held in a gloved hand in 572) may sometimes be confused with an early prolapse, as it appears at the vulval lips when the cow is recumbent. Vaginal polyps can also occur, but they differ in having a smooth, pink noncorrugated surface.

570



571



572



Uterine prolapse

Most cases of uterine prolapse occur within a few hours of calving. They are typically seen in older cows following dystocia or delivery of a large foetus, often associated with hypocalcaemia or a retained placenta. The young Hereford cow in 573 has a prolapse of less than two hours duration. The placenta is still attached and has a moist, fresh appearance. Most animals re-

main recumbent. Those which do move may traumatise the prolapse, increasing the risk of death from haemorrhage and shock. The Shorthorn cow in 574 has a complete prolapse of the uterus, vagina and cervix. This is a rare condition and, like many such cases, although the prolapse was replaced, she died within 12 hours as a result of shock and internal haemorrhage.

573



574



On postmortem, the incised horn exposed necrotic cotyledons in brown, purulent fluid (567). An area of caseopurulent perimetritis is seen above the incision, with discolouration and inflammation extending over the cervix and onto the pelvic vagina (A).



567

Vaginal prolapse

Although it may be seen after parturition, vaginal prolapse typically occurs in older cows in late pregnancy. It is associated with excess perivaginal fat, oestrogenic factors in feed leading to pelvic ligament relaxation, and with certain beef breeds, particularly Herefords. The fresh, red appearance of the prolapse in 568 indicates that it is recent, with only mild congestion from exposure. A plug of cervical mucus is visible at the

lower extremity. Prolonged cases become engorged and irritant, stimulating straining. Prolapse of the vaginal wall with dystocia, as in 569, is uncommon. The vagina is the large everted structure protruding from the vulva and ending at the cervix (A). The foetus is still within the placenta, its forefoot being palpable through the partially dilated cervix.

568



569



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564



565



Clear mucus containing white flecks (561) is believed to indicate a low-grade endometritis. A thick, white discharge (562) is typically indicative of a significant endometritis, especially if accompanied by a purulent smell. *Actinomyces (Corynebacterium) pyogenes* and *Fusobacterium necrophorum* are organisms that are commonly involved. Some cases have blood mixed with white globules (563). In 564, a case of chronic endometritis and pyometra, the incised uterine horns reveal a mass of caseous material. The enlarged uterus indicates a pyometra, which is an accumulation of uterine pus, with or without a vaginal discharge.

Metritis is indicated by a stinking, brown discharge (565), particularly when the discharge is fluid and not mucoid in consistency. Affected animals often show systemic involvement. For example, the cow in 566 was scouring and recumbent, with a sunken eye ex-



566

posing a congested conjunctiva. She died within a few hours as a result of toxæmia and severe dehydration.

Vulval discharges, endometritis, metritis and pyometra

Vulval discharges may be associated with septic vulvovaginitis, a retained placenta, metritis and endometritis. Examination and treatment of endometritis is an important part of routine herd fertility control, especially in dairy herds. The type of discharge depends on the interval from calving to clinical examination, and on the degree of endometritis. Many discharges are normal and do not require treatment. Postoestral

blood in clear mucus may be encountered (556). A plug of cervical mucus (557), which may be seen immediately prepartum or postpartum, is normal. Clear mucus containing pink streaks (558), and discoloured mucus containing red-brown material (559), or globules of yellow detritus (560), are also examples of lochia that would not normally be treated.

556



557



558



559



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Rectovaginal fistula

Rectovaginal fistula is a complication of dystocia, resulting from an oversized foetus. In 552 (taken five days post-partum) the ventral anal mucosa is torn and there are extensive lacerations to the dorsal vaginal wall. The white material on the vaginal floor originates

from intrauterine therapy. Three months later (553) the vaginal and anal lacerations had healed spontaneously, leaving a small, deformed area. Fertility is usually reduced, although this cow became pregnant in each of the next two years.

552



553



Septic vulvitis and vulvovaginitis

In 554 small, infected skin fissures are seen around the dorsal margin of the enlarged vulva, four days after the difficult delivery of an oversized calf. A length of placenta is seen in the ventral vulva. In severe cases of septic vulvitis the vulva is inflamed and oedematous, especially at the ventral commissure, and there is often a purulent haemorrhagic discharge from the vulva. A raised tail indicates discomfort. Vulval oedema and cellulitis are not always the result of trauma at parturition; the condition may also be the result of irritant faeces caused by acute diarrhoea.

Retained placenta

A retained placenta (555) is typically associated with factors that interfere with the third stage of labour, such as twins, prolonged parturition, excessive manual interference, abortion and premature calving, cows that are overfat or too thin, and certain mineral and trace element deficiencies, for example, selenium. In 555, taken four days postpartum, the placenta is turning pink due to autolysis, and the udder is stained with a foul uterine discharge.

554



555



Uterine torsion

The anterior vagina can be seen to be rotated clockwise (549). About 75% of cases involve an anticlockwise torsion of 90–360°. Torsion develops at the very end of pregnancy, during late first-stage or early second-stage labour, and is usually associated with a large calf. A live calf was delivered from this cow, following correction of the torsion, but many are stillborn.



549

Post-partum complications

Normal, unassisted births result in few complications. However, after dystocia, particularly in cases of maternal disproportion involving considerable traction, complications are frequent. The most common is endometritis, which depresses subsequent fertility. Some of the more dramatic, but fortunately less frequent, complications illustrated here include vaginal wall rupture, uterine and other prolapses, rectovagi-

nal fistula and septic vaginitis. A retained placenta can follow a normal parturition. Manual or endoscopic examinations of discharges from the cervix and anterior vagina play an important role in prebreeding examinations carried out as part of a herd fertility control programme. A range of discharges encountered has been illustrated with some gross uterine pathology.

Vaginal wall rupture and haemorrhage

Vaginal wall rupture with haemorrhage is a common complication, seen especially in overfat heifers with large calves, insufficient lubrication during traction, and excessively rapid traction that does not permit normal vaginal and vulval dilation. Preventive episiotomy is useful. Typically, the lateral vaginal wall tears approximately 10–20 cm from the vulval lips, at the level of the external urethral orifice. A large mass of pelvic fat may prolapse through the tear and protrude

through the vulval lips (550). Rupture of the vaginal artery, a branch of the internal pudendal artery that is easily palpated in the lateral vaginal wall at the point of tearing, can result in severe and often fatal haemorrhage within an hour of parturition (551). Fortunately, the blood vessel was identified and ligated in this heifer, although she subsequently developed a severe perivaginitis and localised pelvic peritonitis.

550



551

Head and one leg presentation

In **545** a more long-standing case of dystocia (leg back) is illustrated. The head and tongue are swollen and oedematous and the head is dry. The enlarged and oedematous vulval lips may persist for 24–48 hours after parturition.



545

Posterior presentation, with foetal dorsoventral rotation

Initial observation of the calf's feet and fetlocks in **546** might suggest a case of anterior presentation, with lateral deviation of the head (head back). Closer inspection shows the hocks at the vulva, but the point of the hock is ventral. Rotation facilitated delivery of a live calf.



546

Breech presentation (hip flexion)

In **547** only the tail is visible and there is no vulval enlargement. Since insufficient foetal mass can enter the birth canal to stimulate abdominal contractions, many breech presentations pass unrecognised for several hours, or even days, and the calf is stillborn.



547

Anasarca

Note the subcutaneous oedema over the head, chest and abdomen in the anasarca calf in **548**. A neglected case, it led to maternal death from uterine rupture. Foetal anasarca in Ayrshires is hereditary. Other foetal monstrosities leading to dystocia include arthrogryposis (**12**), schistosomus reflexus (**8**), perosomus elumbus and ascites.



548

Uterine fibromyoma

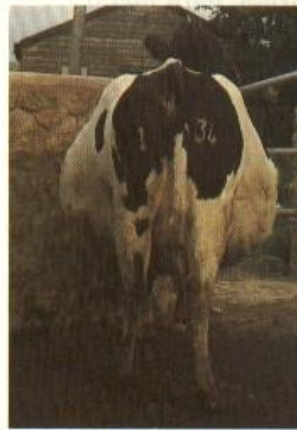
Seen as a smooth mass involving much of the uterine wall (542), this type of tumour does not necessarily interrupt pregnancy. Tumours of the uterus and cervix are rare in cattle.



542

Hydrops allantois (hydrops amnii)

In hydrops allantois (hydrallantois) the lower abdomen is grossly distended bilaterally as a result of excess fluid accumulating in the uterus, usually in the allantoic sac (543). The condition develops progressively in the seventh to ninth months of pregnancy, causing death of the foetus, and may result in the rupture of the prepubic tendon (121). Fluid volumes of up to 300 litres have been recorded (normal volume is 8–10 litres). Shock, dystocia and retained placenta are common complications, which frequently are fatal.



543

Dystocia

Dystocia in cattle may be due to twins, foetal postural defects, foetal monstrosities (e.g., anasarca, 548, and schistosomus reflexus, 8), maternal problems (e.g., uterine torsion), and disproportion between foetal and maternal size. The latter is the most common cause, especially in heifers, and typically results from small

undersized heifers, or from inappropriate bull selection leading to an oversized foetus, or from the restriction of available space in the pelvic birth canal by maternal overfeeding. The conditions illustrated in this section are chosen as examples. The list is by no means comprehensive.

Head only presentation

The case in 544 is not a long-standing dystocia, as the head is moist and of normal size. The shoulders will be at the pelvic inlet, the forelimbs in the uterus.

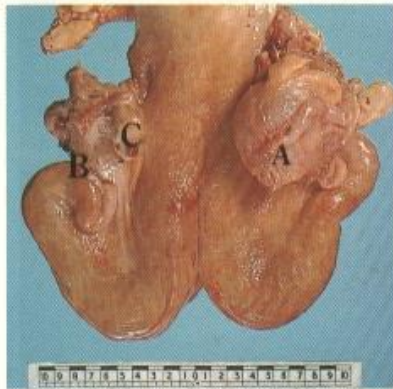


544

Bursal adhesions and hydrosalpinx

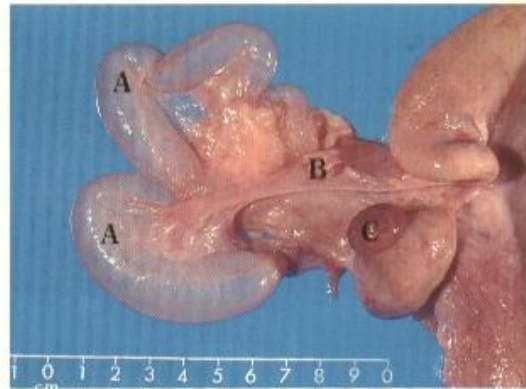
The bursa in 539 is tightly adherent to a large cyst in the right ovary, the oviduct (A) of which is distended with fluid (hydrosalpinx). The small visible portion (B) of the left oviduct is normal and the left ovary contains a 3–5-day-old corpus luteum (C). Bursal adhesions can result from rough handling of the ovary in, for example, manual rupture of ovarian cysts and enucleation of corpora lutea.

539



Hydrosalpinx is more pronounced in the oviduct of 540, which is grossly distended with fluid (A) following a loss of patency. A small segment of normal duct (B) is visible on the bursa, as well as a 6–8-day-old corpus luteum on the ovary (C). The aetiology may involve inflammation arising from an ascending uterine infection or be traumatic, for example, following manual ovarian manipulation.

540



Female genital tract tumours

Granulosa cell tumours are by far the most common ovarian neoplasms, but fibromas, sarcomas and carcinomas have been reported. Uterine fibromyomas,

leiomyomas and lymphosarcomas are rare, whilst fibropapillomas (polyps) of the vagina and cervix are not uncommon.

Ovarian granulosa cell tumour

A large cystic neoplasm is seen in the right ovary in 541. Initially oestrogen-secreting, such tumours cause nymphomania. Advanced cases undergo luteinisation, leading to anoestrus or even masculinisation. The incised uterine horn shows endometrial hyperplasia and mucometra.

541



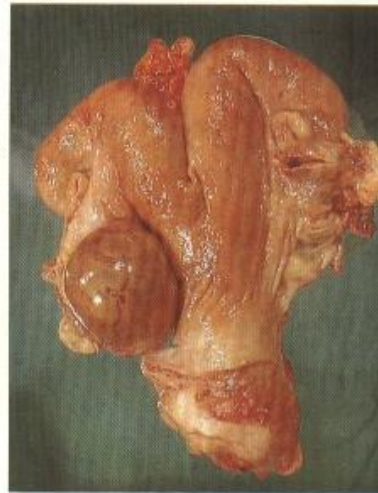
Cystic ovaries

Ovarian cysts arise from a failure of ovulation. The anovulatory follicle increases in size to produce a fluid-filled structure greater than 2.5cm in diameter, and normal ovarian cycles are usually interrupted. Occasionally, cysts develop during pregnancy. Stress, deficiencies, feeding for high milk yields and heredity are

among the suggested causes. Although classically subdivided into luteal and follicular cysts, there is probably a degree of interchange between the two states. Many cysts resolve spontaneously, whilst others require treatment.

Luteal cyst

In 536 a single, large, spherical, thick-walled cyst is present in the left ovary. Luteal cysts secrete progesterone and may lead to prolonged anoestrus. The right ovary contains an incised cystic corpus luteum, a structure which does not impede normal cyclical behaviour.



536

Follicular cyst

In 537 the right ovary contains a large, thin-walled follicular cyst. Such cysts are invariably oestrogenic and lead to irregular or prolonged oestrus periods. Multilocular follicular cysts frequently occur. A corpus luteum, 5-7 days old, is present in the left ovary, suggesting that normal cyclicity can continue in the non-

affected ovary. Cows with unresolved follicular cysts may develop a raised tail head as a result of relaxation of the pelvic ligaments (538), and characteristically male behavioural changes, such as deep bellowing and pawing the ground.

537



538

Segmental uterine aplasia ('white heifer disease', imperforate hymen)

Segmental uterine aplasia is a developmental defect of the müllerian duct system, in which ovarian development allows normal oestrus behaviour, but the hymen is often persistent. Pregnancy may occur in mild cases, with the persistent hymen sometimes leading to dystocia. In the advanced case shown in 533, the right uterine horn is aplastic, the residual portion (A) being dilated with cyclical fluid. This could be classified as uterus unicornis. The condition is due to a sex-linked recessive gene, but, despite its popular name of white heifer disease, it is not always related to coat colour.



533

Double cervix (double os uteri externum)

Only the external cervical os is duplicated in this second example of a müllerian duct defect (534). An endoscopic view (535) illustrates placental mem-

branes, visible through the left (upper dark) os. This inherited condition leads to surprisingly few incidents of dystocia.

534



535



Diseases and disorders of the female genital tract are numerous. This chapter starts with a description of anatomical, congenital and developmental abnormalities, including cystic ovaries and neoplasia of the tract. The latter is comparatively rare. Dystocia is difficult to illustrate. Many conditions are diagnosed and corrected by intravaginal and intrauterine manipulation. Postpartum complications include vaginal wall rupture and haemorrhage, prolapse of parts of the genital tract (ute-

rine prolapse is the most common) and metritis, endometritis and pyometra, all of which are sequelae of dystocia, which in turn is commonly the result of poor bull selection. There is often a conflict of interest between the use of a large breed bull to produce valuable offspring and a small breed to facilitate easy parturition. Not all pregnancies reach term and the final section of the chapter illustrates some causes of abortion and premature calving.

Congenital abnormalities

Intersexuality and freemartinism result from placental fusion in early pregnancy. Segmental aplasia of the müllerian duct system is inherited and leads to a range of abnormalities including white heifer disease (imper-

forate hymen). Ovarian agenesis, ovarian hypoplasia and fallopian tube aplasia have all been reported, but they are rare and, therefore, are not illustrated.

Freemartinism

530



In cattle, over 90% of twin calves have fused placentae, with a common blood supply. **530** shows how small the point of fusion may be. The heifer calf starts its development as a female, but, owing to the interchange of embryonic cells and hormones between the thirtieth and fortieth days of pregnancy (i.e., before the stage of sexual dimorphism), many develop male characteristics. The freemartin is probably masculinised by the secretion from its own gonads. The Friesian heifer in **531** has an enlarged clitoris, and excess hair is growing as a tuft from the ventral vulval commissure. On rectal examination, no internal genitalia could be palpated beyond the cervix. Varying degrees of hypoplasia and masculinisation may be seen. **532** demonstrates hypo-



531



532

plasia of the anterior vagina (A), an absence of the cervix, vestigial ovaries (B) and testes (C) that are joined to the immature uterine horns by ducts.

Scrotal frostbite

Moderate frostbite affected the bottom of the scrotum of a two-year-old Simmental (528) following exposure to a temperature of -30°C in Saskatchewan, Canada, 2–8 weeks previously. The semen quality was poor ($<10\%$ live cells). Most cases return to normal semen quality within 2–3 months.



Seminal vesiculitis

Although the right seminal vesicle of the bull in 529 is normal and the ampulla has its lumen exposed, the left ampulla is absent and the left seminal vesicle shows cystic, haemorrhagic and mild inflammatory changes. Seminal vesiculitis causes a purulent, preputial discharge after service, or pus may be seen in semen collected for artificial insemination (AI). Common organisms include *Actinomyces pyogenes*, *Brucella* and *Escherichia coli*. Young bulls are predominantly involved. Seminal vesiculitis is readily diagnosed by rectal palpation. Lack of symmetry, firmness and pain are the significant findings.



Female genitalia

Introduction

Maintenance of optimum fertility is of major economic importance in both beef and dairy herds. A high lifetime output of milk and calves can only be attained if cows breed regularly, and considerable effort is expended on veterinary fertility examinations, health control, disease prevention and optimising nutrition to achieve this. Much of this work cannot be adequately

illustrated. For example, mineral and trace element deficiencies may affect fertility by reducing conception rates or interrupting ovarian cycles, but they cannot be demonstrated pictorially. Poor management techniques, particularly heat detection, which is very important, can often only be demonstrated by an analysis of records.

Scirrhus cord

The scrotum is very swollen in the four-month-old Friesian calf in 525. A dried blood clot lies over the ventral scrotal incision (castration). Exploration revealed an enlarged stump of the spermatic cord, which resulted from infection acquired at surgery. Such wounds predispose calves to tetanus.



525

Scrotal necrosis and gangrene

The Friesian calf in 526 has an irregular necrotic line at the scrotal neck, separating gangrenous from normal tissue. The reaction is a result of faulty application of a bloodless castrator (Burdizzo). A continuous, crushed line encircles the scrotal neck, cutting off the blood supply to the lower skin. The same effect is obtained when a rubber castration ring is placed around the scrotal neck, and all tissue distal to the ring undergoes atrophy. When this is done relatively late on, i.e., after one week old, the reaction is much more severe. In the Friesian in 527 the ring was applied at two

months. Note the considerable swelling proximal to the ring, compared with the shrivelled, dark, necrotic, distal portion.

If a bloodless castrator is applied too high, the urethra may be accidentally crushed, leading to urethral rupture, and a ventral, subcutaneous accumulation of urine similar to that following calculus obstruction (499). Many countries have legal (statutory) limits on the age at which Burdizzo and rubber ring castration may be carried out.

526



527

Scrotal hernia

In 522 a six-year-old Hereford bull shows an obvious swelling in the left side of the scrotal neck. It was soft, painless and partially reducible. This scrotal hernia resulted in the production of very poor quality semen. The hernia had been acquired as a result of traumatic injury, and was not congenital. Scrotal hernia is rare in cattle.



522

Orchitis

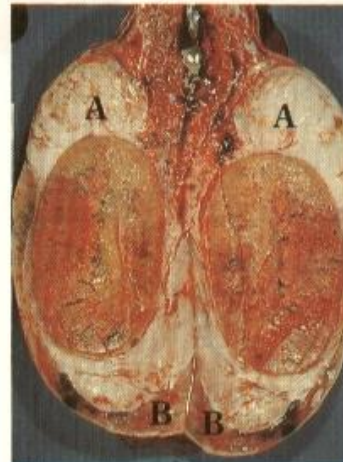
In 523 the scrotum of a four-year-old Simmental bull shows enlargement of the right testis, which is more dependent than the left. Note that the scrotal neck is not swollen. The testis was painful and sensitive to touch. The aetiology of this unilateral orchitis was probably traumatic, although various pathogens, including *Brucella abortus*, *Mycobacterium tuberculosis*

and *Actinomyces pyogenes*, have been isolated. In the acute *Brucella* orchitis illustrated in 524, the inflammatory reaction in the tunics and epididymis caused a severe periorchitis (pale areas (A)), with early testicular necrosis as a result of testicular enlargement, and compression by the tunica albuginea. Ventrally, oedematous fluid lies subcutaneously (B).

523



524



Posthitis and balanoposthitis

Posthitis is an inflammation of the prepuce. The post-mortem specimen of an eight-year-old Santa Gertrudis in **518** shows severe necrosis of the preputial mucosa both at the skin-mucosa margin, and more caudally.

Balanoposthitis is an inflammation of both the prepuce and the penis. The Jersey bull in **519** shows chronic fibrotic changes that involved both penile and

preputial mucosae, causing adhesions. In the Hereford bull in **520**, the penis is partially extruded to illustrate the marked congestion and inflammatory reaction on the preputial mucosa. The preputial orifice (A) is swollen as a result of the posthitis. The paler penis has several discrete papules. Some cases of balanoposthitis are due to genital IBR infection (**227**), while others are of traumatic origin.

518



519



520



Scrotal conditions

Inguinal hernia

There is a soft, reducible swelling in the inguinal region overlying the two rudimentary teats in this Sussex bull from Zimbabwe (**521**). Neither the scrotal neck nor the body is enlarged, showing that only the inguinal canal is involved. An inguinal hernia may contain omentum, or both omentum and small intestinal loops. Cattle have a genetic predisposition to inguinal hernia, inheritance being recessive. Affected bulls should not be used to sire replacement stock. In over-conditioned animals it can be difficult to differentiate fat deposits from a hernia.



521

Penile and parapenile haematoma ('fracture of penis', 'broken penis')

A discrete swelling is seen in the Hereford bull in **514**, which also had a secondary prolapse of the penis. The tunica albuginea is ruptured, producing a prescrotal haematoma and oedema. This rupture involves the corpus cavernosum penis (CCP) and is almost always through the dorsal wall of the tunica, just distal to the sigmoid flexure. The extent of the

ruptured CCP is evident in the postmortem specimen of an affected penis (**515**). Rupture occurs at ejaculation, or, less commonly, at intromission when the fully engorged penis is suddenly bent beyond its physiological limits, for example, when the cow or heifer suddenly moves.

514



515

Preputial conditions

Prolapsed prepuce (preputial eversion)

516



Preputial prolapse occurs as a breed characteristic in *Bos indicus*, e.g., Brahman and Santa Gertrudis, and in polled breeds. A partial preputial prolapse of comparatively recent onset is shown in a six-year-old Brahman from South Africa (**516**). The mucosa has a granular appearance, with areas of superficial haemorrhage. More severe cases are very prone to secondary trauma and oedema.

Preputial and penile abscess

In the five-year-old Hereford bull in **517**, the penis has been manually prolapsed. The hand holds the prepuce and penis just caudal to the point of attachment of the preputial mucosa (internal lamina) to the body of the penis, shown as a transverse fold. Pus oozes from a mucosal tear incurred when the penis was extended. Deep-red erectile tissue is evident in the defect. Below the wound, the mucosa is smooth and slightly pinkish-grey due to a further abscess pocket.



517

Penile conditions

Fibropapilloma

The two-year-old Friesian bull in **510** has several highly vascular, ulcerated masses attached to the glans penis. Caudal to the large mass is a smaller, more sessile fibropapilloma. These are typical sites for such multiple, proliferating masses, which are in-

fectious, of viral origin, and relatively common in groups of young bulls confined in a small area. Four months later the mass had largely spontaneously disappeared (**511**), and the bull could be used for natural service.



Spiral deviation of penis ('corkscrew penis')

Spiral or corkscrew is the most common form of penile deviation. It is a normal occurrence at ejaculation, but premature corkscrewing may be severe enough to prevent intromission. The first case, a two-year-old Charolais, shows a 90° ventral curvature (**512**). The second case (**513**) clearly illustrates the spiralling

effect, and the difficulty of intromission. In some bulls, an ulcer on the glans penis indicates abrasion from repeated perineal contact. Spiral deviation is due to slipping of the dorsal apical ligament of the penis and may occur intermittently.



Persistent frenulum

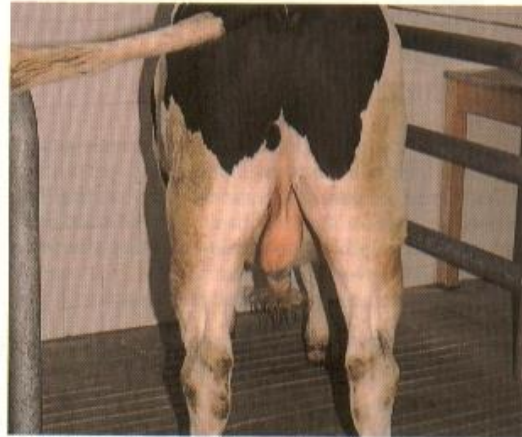
507



In 507 the penile body remains attached to the prepuce by a fine, longitudinal band(A). Persistent penile frenulum causing penile deviation is a congenital anomaly, but signs, such as ventral penile deviation or a failure of complete protrusion, are usually first seen at attempted intromission. The cause is incomplete separation of the penis and prepuce along the ventral raphé during the first year. In some breeds it is inherited, and surgically corrected bulls should not be used to sire replacement animals.

Testicular hypoplasia with cryptorchidism

The left testicle is descended and of normal size in the Friesian calf in 508. The right testicle, which is small and incompletely descended, is in the scrotal neck.



508

Cryptorchidism

509



Bovine cryptorchidism, which is rare, is possibly associated with the polled character. In the four-week old Hereford cross calf in 509, the normal right testicle is in the scrotal sac, but the left testicle is in an inguinal position (A). The misplaced gonad has deviated from the normal course of descent and may be termed an 'ectopic testicle'.

Cystitis

The six-month-old heifer in **505** passed urine frequently and in small amounts. The perineal region had a foul odour of stale urine and shows excoriation as a result of urine dribbling. The tail is slightly elevated (urinary tenesmus).



505

Male genitalia

Introduction

The anatomical separation of parts of the male genital tract, and their common development with parts of the urinary tract, makes integration of this section difficult. The section starts with congenital conditions, and continues with abnormalities affecting the penis,

prepuce, scrotum, and, finally, the epididymis and seminal vesicles. Some congenital anomalies (e.g., persistent frenulum, cryptorchidism and testicular hypoplasia) may not become apparent until breeding age (1–2 years old).

Congenital male genital abnormalities

Pseudohermaphrodite

In the one-year-old Africander bull in **506** the preputial opening and galea glandis are shown at A. The penis is situated at the ischium and, although the scrotum is absent, the testes are in the inguinal region. The condition is rare. The animal may be mistaken for female at birth owing to the origin of the urinary flow. The umbilicus usually has a skin fold reminiscent of the prepuce.

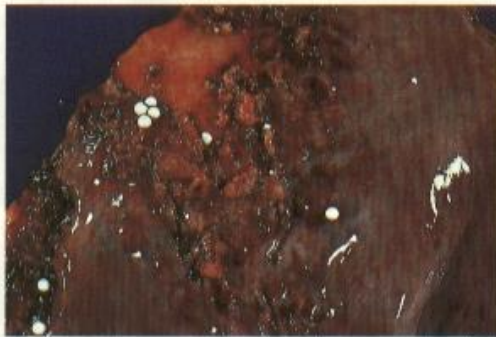


506

Postmortem examination of a six-year-old Short-horn bull that died as a result of severe uraemia following bladder rupture and uroperitoneum, reveals a congested and haemorrhagic bladder mucosa (501). Numerous calculi (2–7mm diameter) and fibrin are seen on the mucosal surface. In 502 the peritoneum is diffusely inflamed, but the changes are less severe

than those following septic reticuloperitonitis (205 & 206). Urolithiasis is frequently seen in cases of severe pyelonephritis (494). *Differential diagnosis:* includes cystitis (505), urethral obstruction (497–500), severe balanoposthitis (518–520) and severe preputial frostbite.

501



502



Amyloidosis

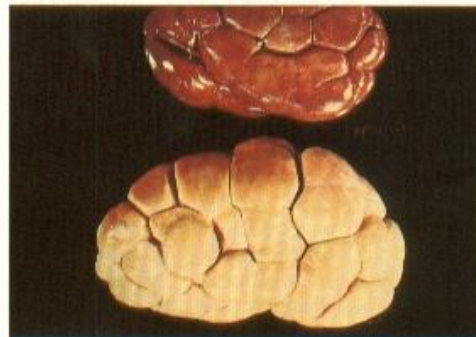
The marked presternal oedema in the three-year-old Limousin bull in 503 was caused by severe bilateral amyloidosis, which is characterised by polyuria and massive proteinuria leading to pronounced hypoproteinaemia.

Secondary amyloidosis is associated with chronic suppurative conditions. The bull's kidney in 504 is markedly enlarged, pale, waxy and granular in comparison with the normal kidney above. This degree of enlargement should be detectable on rectal palpation.

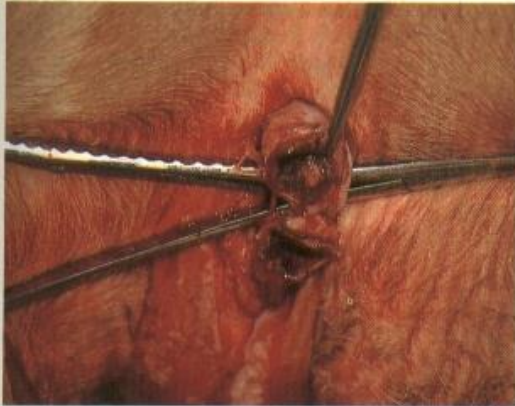
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504



497



proximal to the sigmoid flexure, or in the distal portion of the penis. An intraoperative view (497) of the perineal region shows the dilated urethra proximal to the sigmoid flexure and the obstructing calculus. If complete urethral obstruction persists, either bladder or, more commonly, urethral rupture occurs. The Hereford steer in 498 has a large subcutaneous swelling containing urine as a result of urethral rupture in the sigmoid region. The swelling extends forwards from the sigmoid to the preputial orifice, which is discoloured and shows dry preputial hairs covered with crystals. Sometimes the swelling is unusually discretely localised to the peripreputial area. In contrast, in the severe and advanced case in 499, the Friesian steer had such severe swelling that ischaemic necrosis has caused an extensive skin slough overlying the penis. *Differential diagnosis:* in a mature bull this includes penile haematoma (514) or abscess formation, or, in a younger animal, urethral rupture due to faulty application of a bloodless castrator (Burdizzo) some days previously (see p.161).

In another Hereford steer (500) it is the bladder rather than the urethra that has ruptured as a result of urethral obstruction, and urine has gathered in the ventral abdominal cavity, causing a progressive swelling and distension of the flanks. *Differential diagnosis:* for ventral abdominal swelling this includes ascites (207), intestinal obstruction (204), and generalised peritonitis with massive exudation (206).

498



499



500



third example of pyelonephritis (494) shows renal calculi in the calyces, further calculi within the lumen of a thickened ureter, and multiple petechiae (A) on the mucosa of the bladder wall.

Pyelonephritis is usually an infection that ascends from the vagina and vulva. Caused by *Corynebacterium renale*, it may result from contact with infected urine or from a genital tract infection. Affected cows are pyrexical, lose weight, and may develop a dry, brownish discolouration of the coat.



494

Leptospirosis

The main effects of *Leptospira interrogans* serovar *pomona* or *hardjo* infection are abortion (see 575 for a foetus from a possible leptospiral abortion) and loss of milk production in adult cattle. When *pomona* only is involved, an acute septicaemia, with haemoglobinuria, jaundice, anaemia and possible death, is seen in calves. Dark swollen kidneys (495) are usually indicative of a haemolytic crisis. Recovered cattle show little more than ill-defined, greyish, cortical spots, indicative of a focal interstitial nephritis. The spirochaete may be seen under dark field microscopy of urine, but confirmation of diagnosis otherwise depends on serology or histopathology. *Differential diagnosis*: babesiosis (655–660), anaplasmosis (661–664), rape and kale poisoning (707), post-parturient haemoglobinuria, and bacil-



495

lary haemoglobinuria (213). Note the completely different appearances of the kidney in pyelonephritis (491–493) and amyloidosis (504).

Urolithiasis

Urolithiasis has a multifactorial aetiology including a relatively reduced fluid intake, mineral imbalance, high concentrate intake and castration. The condition begins with microcalculus formation in the kidneys, and clinical problems arise when the calculi grow to a sufficient size to obstruct the urethra.

Although preputial crystals (often struvite, i.e., magnesium-ammonium-phosphate hexahydrate) appear in many calves (496), relatively few will develop signs of obstruction, which tends to occur in or just



496

10 Urinogenital disorders

Urinary tract

Introduction

The main infectious and bacterial diseases of the bovine urinary tract are pyelonephritis and leptospirosis. Urolithiasis is a multifactorial urinary problem resulting from metabolic and nutritional disorders. Finally, amyloidosis, although an uncommon sporadic disease of adult cattle, requires differentiation from pyelonephritis.

Conditions with secondary renal pathology include pruritus–pyrexia–haemorrhagica (PPH) (485), oak (acorn) poisoning (703 & 704), renal infarction secondary to caudal vena caval thrombosis (255), and babesiosis (redwater, 655).

Pyelonephritis

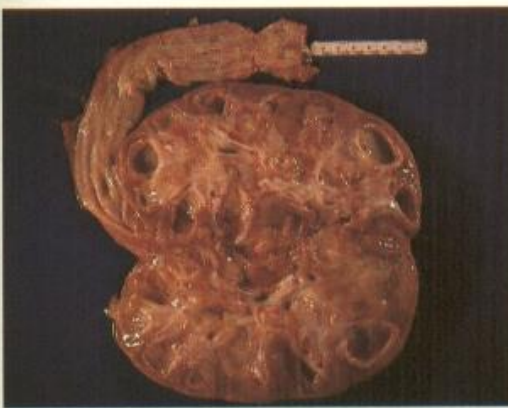
491



492



493



A mature cow with uraemia shows superficial, dark areas of infected thrombi in an enlarged kidney (491) from which *Corynebacterium renale* was cultured. In 492 and 493 severe chronic pyelonephritis is illustrated. In 492 the left kidney is contracted and pale, and the right kidney is enlarged and appears granular. Both ureters, particularly the left, are thickened as they contain pus and cellular debris (pyoureter). In 493, the sectioned kidney of an active case (in a five-year-old Charolais cow) shows multiple caseous and purulent centres, primarily in the medulla. The numerous blood-filled cavities are septic foci. The

Electrocution

Electrocution is quite commonly seen in cattle, partly owing to an inherent susceptibility, and partly because they are more often exposed in milking parlours (490). Clinical signs vary from being stunned, with resulting nasal, oral and ocular bleeding, to death (as in the cows in 490), also with profuse bleeding. Death is due to ventricular fibrillation and respiratory arrest. Exposure to lower levels of high amperage electric current produces a variety of nervous and behavioural changes, depending on the voltage intensity.



490

Salt-craving pica

Prolonged, deficient diets lead to an intense craving for salt. Affected animals will often lick and bite any object (pica), and may avidly attack salt blocks (486). Milk production, food intake, growth and fertility may be depressed.



486

Lightning stroke

487



488

489



Animals that have been struck by lightning are typically found beside a hedge, a wire fence (487), or under a tree. The tree may show evidence of lightening damage. Trees that have shallow-spreading root systems are particularly dangerous, especially if the ground is damp or has underground drains. Dead animals may be found with fresh food in the mouth and scorch marks of burned hair on the coat, especially on the legs (488). Removal of the hide reveals extensive bleeding due to rupture of the subcutaneous blood vessels (489). Mildly affected animals may recover after a variable period of time. *Differential diagnosis* (of sudden death): hypomagnesaemia (453), bloat (180), pulmonary thromboembolism (251–254), cardiac failure (see Chapter 6), anthrax (682).

Bovine spongiform encephalopathy (BSE)

Cows (generally of dairy breeds) that are between three and six years old are primarily affected by bovine spongiform encephalopathy. Occasional cases occur in bulls. Clinical signs include weight loss (483), an unsteady, stiff-legged gait, especially in the hind legs, and behavioural changes such as teeth grinding, muscle twitching, nervousness and aggression. Severe posterior ataxia and, eventually, recumbency develop after a period of days to months. The change in gait is difficult to visualise in a photograph. The Friesian cow in 484 shows an arched back and excessive straightness of the hind legs as she turns to her left. She was

difficult (almost dangerous) to handle. Typical microscopic spongiform changes were seen in the brain at postmortem.

First seen in 1986, BSE is largely confined to the UK, Eire and Switzerland at the present time. The precise cause is unknown, but ingestion of a scrapie-like agent in feedstuffs has been strongly implicated. Susceptibility to infection is possibly inherited. The disease is now notifiable in Britain. *Differential diagnosis:* rabies (477–481), Aujeszky's disease (482), meningitis (465–470), brain abscess (463–464) and hypomagnesaemia (453–454).

483



484

Pruritis–pyrexia–haemorrhagica (PPH)

In PPH, raised plaques of skin on the head (485), neck, tail and udder resemble ringworm (88 & 89), but are intensely pruritic. More severe cases are pyrexia, anorexic and pass blood from the mouth, nose and rectum. The cause is unknown, but a fungal toxin, producing white, necrotic renal foci, and sweet vernal grass have both been implicated. *Differential diagnosis:* Aujeszky's disease (482), mange (77), and ringworm (88).



485

form of rabies, with characteristic bellowing (480), aggression and salivation (481), can sometimes also occur in cattle. Countries free of rabies maintain strict quarantine measures for dogs and cats entering from abroad. Many other countries have active eradication

campaigns and a compulsory vaccination policy for certain domestic species. *Differential diagnosis:* bacterial meningitis (465), brain abscess (463), listeriosis (459), botulism (688), Aujeszky's disease (482) and nervous ketosis (457).

480



481



Aujeszky's disease (pseudorabies, 'mad itch')

Although Aujeszky's disease is primarily a herpes virus infection of pigs, other species, including cattle, can develop a meningoencephalitis that is usually fatal within 48 hours. Apprehension, licking, trembling and salivation (482) are early signs, typically followed by an intense pruritus. The grossly swollen eyelids in 482 are the result of intense rubbing to relieve the pruritus.

482



476 *Coenurus cerebralis* ('gid')

Coenurus cerebralis is the intermediate stage of the canine tapeworm, *Taenia multiceps*. It occasionally encysts in cattle brains, producing a slow, progressive nervous disease. Starting with blindness, head pushing and aimless wandering, affected animals eventually become recumbent over a period of 1–4 months. The cyst often lies immediately beneath the frontal bone, from where it can be removed from the external surface of the cerebral hemispheres. This animal made a full recovery (476).



476

Viral infections

Rabies

477



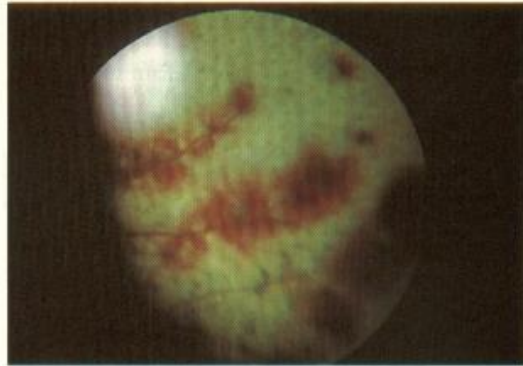
478

Rabies is a rhabdoviral infection that produces a fatal encephalomyelitis. Dogs, cats and wild carnivores are primarily affected, but the disease can occur in all warm-blooded animals, including cattle and man. Carrier animals transmit infective saliva to cattle by biting, e.g., the vampire bat shown feeding from a cow in Brazil in 477, was later found to harbour the rabies virus. The virus then passes to the brain via peripheral nerves, hence the variation in incubation period depending on the site of injury. Initially seen simply as a change in behaviour, early cases progress to show salivation, apprehension, and knuckling of the hind fetlocks, as in the Friesian calf in 478. Some cattle show marked tenesmus (479). This may lead directly to paralysis and death, although the more classic 'furious'



479

few hours. Blindness from retinal haemorrhages (472) and oedema are early features. Marked cerebral oedema, congestion and haemorrhage are seen in a ventral view of the brain (473) at postmortem, with congestion of the grey matter, cerebral haemorrhages (in the lateral ventricles), meningitis and discoloured cerebrospinal fluid (CSF) as in the transverse section (474). *H. somnus* alone can cause a suppurative bronchopneumonia (475) with severe cranioventral changes evident, or it may be involved in shipping fever or pasteurellosis (231).



472

473



474



475

The calf in 466 exhibited a hypopyon (467) which rapidly resolved following treatment. A more extreme case developed extensor spasm (468) and opisthotonos (469), but recovered. Adult cattle can be affected. A range of organisms may be involved including *Strep-*

tococi (470 shows a congested brain at postmortem), *Haemophilus*, *Pasteurella* and *Listeria*. *Differential diagnosis*: rabies (478–481), brain abscess (463), acute lead poisoning (726) and infectious thromboembolic meningoencephalitis (471).

467



468



469



470



Infectious thromboembolic meningoencephalitis (TEME, ITEME) or infectious septic thrombomeningoencephalomyelitis (ISTEM, ISTMEM)

Infectious thromboembolic meningoencephalitis is seen primarily in feedlot cattle and is caused by *Haemophilus somnus*. The correct terminology is disputed. This multisystemic condition is sudden in onset, occurring initially with marked pyrexia. Affected animals are dull and severely depressed, as in the Charolais bull in 471. Note the salivation, drooping ears and eyelids. Recumbency and death may follow within a

471



Brain abscess

The Ayrshire cow in 463 looks apprehensive, holds her head to one side and is unable to stand on her front legs. An abscess (A) was seen in the base of the brain

463



on postmortem (464). A common location for such abscesses is the pituitary fossa.



464

Meningitis

Meningitis produces a range of clinical signs. The calf in 465 is pushing its head against the wall, its pupils are dilated and it is frothing at the mouth. Some calves

(466) are recumbent and dull, with drooping ears and eyelids, giving the appearance of an intense headache. Adult cows may also be affected.

465



466

Bacterial infections

Listeriosis ('circling disease')

A bacterial infection caused by *Listeria monocytogenes*, listeriosis is a meningoencephalitis that produces pyrexia, dullness, blindness and a unilateral facial nerve paralysis, leading to prolapse of the tongue (459) and drooping of the ears. The organism is ubiquitous, being found in most wildlife. Compulsive circling towards the affected side (460) is also often seen, and

abortions may occur, but they are usually not concurrent with nervous signs. The disease is associated with cold weather and silage feeding. *Differential diagnosis*: rabies (478), acute lead poisoning (726), CCN (451), botulism (687), bacterial meningitis (465), viral encephalitis and pituitary abscess (464).

459



460

Middle ear infection (otitis media)

In middle ear infections, the head is typically held to one side, as in the young Friesian bull in 461. However, the animal remained alert, continued feeding and was not pyrexic. The eyelid is swollen owing to rubbing. *Differential diagnosis*: listeriosis (459) and meningitis (465).



461

Facial nerve paralysis

In 462 the ear, upper eyelid and muzzle are drooping. In this bull the cause was unknown, but possible aetiology includes trauma, middle ear disease, listeriosis and other brain infections. *Differential diagnosis*: includes botulism (687), rabies (478) and listeriosis (459).



462

Nervous acetonæmia (ketosis, 'slow fever')

457



Nervous acetonæmia is an intoxication by circulating ketone bodies and is associated with an energy deficit in early lactation. Typical clinical signs are anorexia and lethargy (hence 'slow fever'), although some cases develop nervous signs such as compulsive licking, salivation, biting flanks (as seen in the Guernsey cow in (457) or even maniacal behaviour.

Fatty liver syndrome (fat cow syndrome)

Fatty liver syndrome is related to ketosis and is seen especially in overfat cows that are fed an energy-deficient diet after calving. Many cows show no precise clinical signs. More advanced cases develop anorexia and 'star-gazing', as in the Jersey cow in 458, progressing to terminal recumbency.



458

Hypomagnesaemia ('grass staggers', 'grass tetany').

The Friesian cow in 453 fell and developed extensor spasm when being brought in for milking. Note the 'staring' eye, dilated pupil, frothing at the mouth and sweaty coat. In 454 the crossbred cow from Queensland, Australia, shows similar eye changes. The head and the hind legs are in extensor spasm. Violent paddling movements of the forelegs and head have result-

ed in loss of foliage, exposing the bare earth. Precipitated by stress and seen especially in temperate climates, the condition is induced by grazing magnesium-deficient or high potassium pastures, and other pastures where magnesium uptake is poor. Concurrent hypocalcaemia may be an exacerbating factor.

453



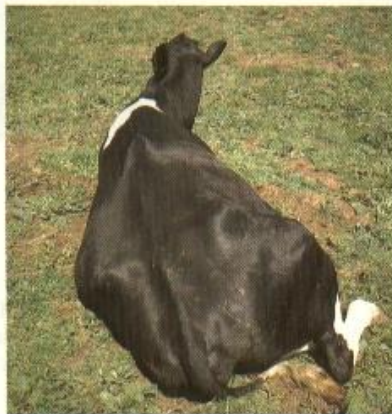
454

Hypocalcaemia ('milk fever', post-parturient paresis)

Hypocalcaemia (455) occurs typically in older cows immediately pre- or post-calving. Affected animals are unable to rise owing to lack of muscle power and poor nerve function. Note also the protruding anal sphincter (due to accumulation of faeces in the rectum, and increased intra-abdominal pressure), slight

ruminal bloat (ruminal atony) and the typical 'S-bend' in the neck. This is thought to be a self-righting response, as the animal attempts to avoid full lateral recumbency. Some affected cows lie with their head resting on their flank (456).

455



456

9 Nervous Disorders

Introduction

The nervous diseases discussed in this chapter are those in which nervous signs comprise the major part of the clinical syndrome. Consequently, a wide range of aetiology is covered including nutritional conditions (e.g., cerebrocortical necrosis), metabolic disorders (e.g., hypomagnesaemia), bacterial and viral infections (e.g., listeriosis and rabies), parasites (e.g., *Coenurus cerebralis*), physical and traumatic incidents (lightning stroke and electrocution) and miscellaneous conditions of uncertain aetiology (e.g., bovine spongiform encephalopathy). However, other diseases

with significant clinical nervous signs may be featured elsewhere. Examples include tetanus (685), botulism (687) and lead poisoning (726).

Nervous conditions may be difficult to appreciate in 'still' photographs, since their clinical assessment is based on changes in behaviour, movement, gait and stance. As such, an understanding of the normal animal is extremely important. Where problems of recognition occur, the text has been expanded in an attempt to describe those changes that cannot be photographed.

Cerebrocortical necrosis (polioencephalomalacia)

Cerebrocortical necrosis (CCN) is a thiamine-related condition, induced by products of abnormal ruminal fermentation (thiaminases). It is seen most commonly in calves that are 2–6 months old, often following a dietary change. In the Friesian calf in 451, note the pronounced opisthotonos, the rotation of the eye to expose the sclera, and the extensor spasm of the front

legs. Postmortem lesions (452) are normally symmetrical and occur in the frontal, occipital and parietal lobes. Congestion and yellow degeneration of the cortical grey matter (A) is seen, typically at the junction of the white and grey matter, particularly on the left and right extremities. Affected brains will fluoresce blue-green under ultraviolet light.

451



452

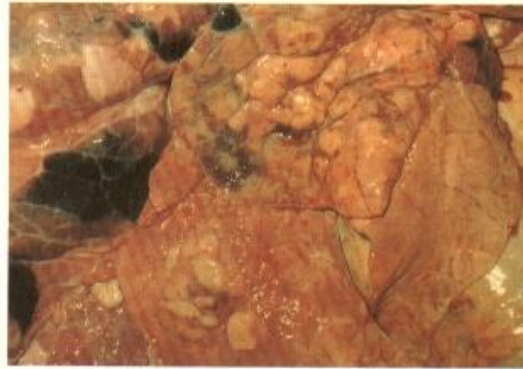


Metabolic diseases

Metabolic diseases are included in this chapter, since many of their presenting clinical signs are behavioural or nervous. Typically, they occur when homeostasis

has been extended beyond physiological limits. Four conditions are illustrated: hypomagnesaemia, hypocalcaemia, acetonaemia and fatty liver syndrome.

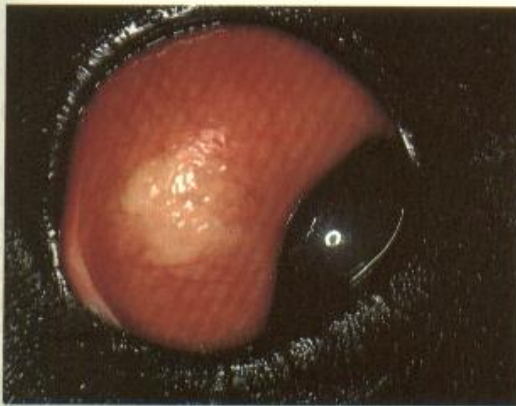
third eyelid (membrana nictitans) at the medial canthus. There is a secondary, superficial, purulent infection. Early lesions are easily removed, but in neglected cases, ten per cent will eventually metastasise to the regional lymph nodes, and a small proportion to the lungs, as in 448. The multiple irregular pale areas are tumour tissue.



448

Lymphosarcoma

449



In 449 a large neoplastic mass has produced a smooth, red, bulbous enlargement of the conjunctiva, compressing the eyeball towards the medial canthus (right). Lymphosarcoma is the most common orbital tumour and causes progressive exophthalmos. The tumour is almost invariably present at other sites.

Papilloma of the third eyelid

In 450 the lesion is attached to the third eyelid by a 'stalk' and has a very irregular keratinised surface. It is much less common than a squamous cell carcinoma, and is easy to remove surgically.



450

Bovine iritis (uveitis, iridocyclitis)

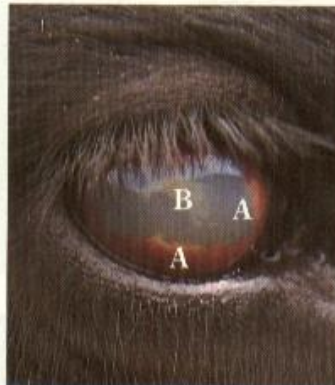
Bovine iritis has been associated with *Listeria* infection from the feeding of big-bale silage. Early cases (443) show an enlarged and wrinkled iris, leading to a central miotic pupil. Near the lateral canthus is a white endothelial plaque on the inner surface of the cornea (Descemet's membrane), with corneal opacity and early pannus formation. As the condition progresses

(444), pannus develops circumferentially (A), with increasing corneal discoloration and opacity (B). In severe cases (445) the endothelial plaques produce a very irregular surface on the cornea and cause complete blindness. However, even such advanced cases may recover following subconjunctival anti-inflammatory and antibiotic treatment.

443



444



445



Neoplastic conditions

Malignancy of the third eyelid (membrana nictitans) and the globe is common in cattle worldwide. Lymphosarcomas may occur within the globe itself, or in

the orbit, leading to prolapse of the globe. Papillomas have been reported occasionally.

Squamous cell carcinoma

Squamous cell carcinoma (SCC) is the most common ocular neoplasm of cattle, and is seen particularly in white-headed cattle, such as the Hereford, and other breeds with little pigmentation around the eye. The disease is associated with ultraviolet light. Common sites for SCC include the lower lid, the third eyelid and

the corneoscleral junction of the globe. The Hereford bull in 446 has SCC at several points along the eyelids (A), a greyish plaque, 10 mm in diameter, extending over the cornea from the corneoscleral junction (B), and early SCC in the third eyelid (C). In the Guernsey cow in 447, pink, neoplastic tissue protrudes from the

446



447

Prolapse of the eyeball (proptosis)

440



Prolapse of the eyeball is an infrequent condition caused by trauma to the head. In the Ayrshire cow in 440, note the congested and oedematous sclera and the eyeball protruding beyond the lids. Repulsion and surgical fixation resulted in a successful recovery.

Eyelid laceration

Lacerations of the lower eyelids are fairly common. They are often caused by an animal rubbing and catching its eyelid on projections from troughs, buildings or fragments of wire. In the Angus heifer in 441, the lower lid injury near the lateral canthus was sustained several days previously and was healing well.



441

Hyphaema

442



Hyphaema is haemorrhage of blood into the anterior chamber. In 442 note the superficial dry keratitis and the fresh blood beneath the cornea. Although hyphaema is usually traumatic, this case was due to sepsis. (See also bracken poisoning, 699).

Ocular trauma

Although the eye is well protected within the bony orbit and by the rapid reflex closure of the lids to approaching foreign bodies, traumatic eye lesions are common, particularly those due to incoming objects. Irritation due to dust or ultraviolet light may produce keratitis and conjunctivitis. The Guernsey cow in 436

has a congested scleral conjunctiva (seen below the upper eyelid), an indistinct pupil, and mild corneal opacity at the medial canthus, probably the result of a blow. The four-day-old Jersey calf in 437 shows marked scleral haemorrhage resulting from dystocia.

436



437

Ocular foreign body

Grass seeds or other plant material may become lodged in the conjunctiva and, as the eyeball moves, repeatedly traumatise the area to produce erosion and ulceration. Cattle reaching up to feed from overhead hay racks are particularly at risk. In 438 a small fragment of plant material (A) is embedded in the corneal

surface near the lateral canthus. Note the surrounding early peripheral keratitis and corneal opacity. Keratitis with early corneal ulceration is seen in the more advanced case in 439. Most of the foreign body is lodged in the lateral canthus, with one small fragment protruding across the cornea.

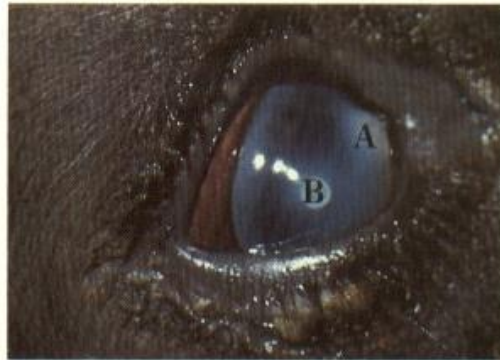
438



439

This will regress when healing is complete. Pannus formation does not occur with shallow, superficial lesions, where the ulcer is seen in a localised area of corneal opacity (430). If corneal rupture does not occur, healing

may be complete, or may leave a small corneal scar (A), as seen towards the medial canthus in 431. Partial sight has been regained. The circular plaque (B) on the cornea is an artefact caused by flash photography.



Deep ulcers may perforate through to the aqueous. In 432, tissue from the iris plugs the ruptured ulcer and can be seen as a red ring protruding from the surface of the cornea. This is a staphyloma. More advanced cases (433) lose their red appearance and some may eventually heal, but they leave an opaque, scarred cornea (434) and glaucoma from impaired drainage of the

aqueous humour.

Secondary infection of the eye (435) (endophthalmitis) leads to pus in the anterior chamber (hypopyon). The eyeball is protruding, there is pannus formation, and the cornea is white and irregular. Sight has now been permanently lost.

Conjunctivitis

Mild conjunctivitis is seen clinically as epiphora. Typically, a wet, black-stained facial area radiates from the medial canthus. More advanced cases (426) show a degree of photophobia. Purulent conjunctivitis (427) may also be seen. Caused by a variety of infections and

irritants, conjunctivitis and epiphora commonly occur in association with other diseases, for example, calf pneumonia (233), IBR (222), IBK (428) and ocular foreign body (438).

426



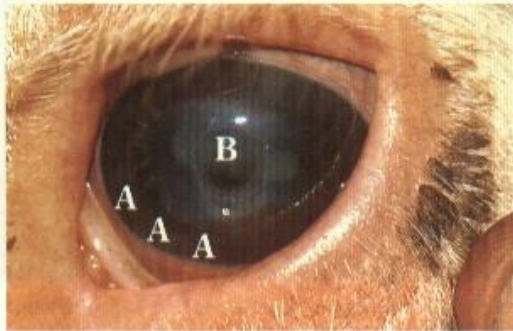
427

Infectious bovine keratoconjunctivitis (IBK, infectious ophthalmia, 'New Forest disease' or 'pinkeye')

A bacterial infection caused by *Moraxella bovis*, IBK produces conjunctivitis, keratitis and corneal ulceration. In mild cases, corneal ulceration may not be apparent. Bright sunlight, dry, dusty and irritant conditions, flies, and a tight stocking density are all predisposing factors. Typically the ulcer is in the centre of the cornea (compare ocular foreign body (438), where it is peripheral) and may be superficial or erode deeply into the stroma (428). The condition is very

painful, leading to photophobia, blepharospasm and epiphora. Note the encrustation of the lower lids due to laceration. Very early corneal vascularisation (A) can be seen in 428, as well as early pannus formation. The pupil (B) is miotic. Later stages (429) develop corneal opacity due to increased intraocular pressure. The bright red rim of pannus (A), progressing from the corneoscleral junction to fill the ulcer, is clearly evident.

428



429

Neonatal corneal opacity

In the stillborn Charolais calf in **423**, a reduction in intraocular pressure led to cloudiness in the cornea and indicated that the calf had died at least 12 hours before birth. The eyeball is slightly sunken in the socket.



423

Acquired cataract

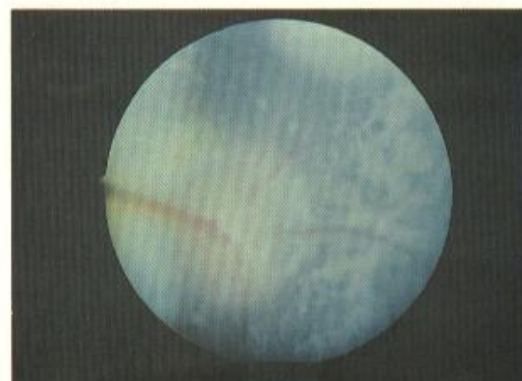
Note the two large synechiae (adhesions of the iris to the cornea), and the opacity and wrinkling of the lens in the Guernsey cow in **424**. Cataracts may be secondary to inflammatory processes within the eye, when they can be progressive. In contrast, congenital cataracts (**419**) are not normally progressive.



424

Vitamin A deficiency

In young growing animals, vitamin A deficiency blindness is associated with stenosis of the optic foramen and consequent pressure on the optic nerve. The pupil becomes dilated and degenerative changes may be seen on the retina (**425**). The optic disc is pale and enlarged, with indistinct margins (papilloedema). White mottling of the nontapetal area suggests chorioretinal mottling. The steer was blind. (The diet had been barley straw, rolled barley and, occasionally, poor-quality hay.)



425

Congenital cataract

Both eyes of the four-day-old Hereford crossbred calf in 419 were affected and the animal was totally blind. In other animals, only one eye may be affected, or the cataract may not cause total loss of vision. Congenital cataract is not normally progressive. Even blind cattle can be reared in confinement systems. They quickly

learn to remain within the group, although handling can be difficult. Congenital cataract may be inherited, or may result from the teratogenic effects of maternal BVD infection during early/mid pregnancy. 420 shows a congenital nuclear cataract in a young Friesian calf.

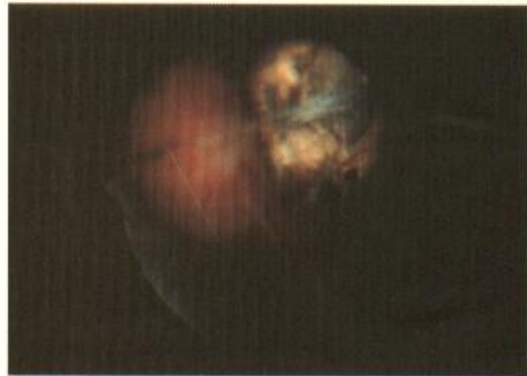
419



42

Coloboma

A coloboma is a congenital cleft caused by failure of the embryonic optic fissure to close. It can occur in the eyelids, iris, lens, or, as shown in 421, the retina. Note the pale area devoid of functional retinal cells. The condition is inherited in certain breeds of cattle (e.g., Charolais), but vision is not normally impaired.



42

Strabismus ('squint')

Strabismus may be convergent, when the visual axes of the eyes converge more than is required for normal vision, or divergent. 422 shows divergent strabismus in the left eye of a Guernsey heifer. Exophthalmos with strabismus may be inherited, although it is often unnoticed until 6–9 months old. Sometimes known as 'wall eye', this term more commonly refers to a blue-grey discoloration within the globe.



42

8 Ocular disorders

Introduction

Disorders of the eye are relatively easily seen and photographed. The disorders may be congenital, nutritional, infectious, traumatic or neoplastic in origin. Examples of each are illustrated. Some conditions, for example, infectious bovine keratoconjunctivitis (IBK), occur worldwide, and may be a significant

cause of economic loss. Pain associated with the active phase of disease restricts feeding and leads to weight loss. If sight is lost, affected animals are less able to forage, particularly under extensive ranch conditions, and they are more susceptible to predators.

Congenital disorders

Although congenital abnormalities are, by definition, present at birth, some may not be recognised until the calf is much older. Strabismus (squint) is a typical example. Congenital disorders may be genetic, and therefore inherited, or they may be caused by environmental factors. Some abnormalities have more than

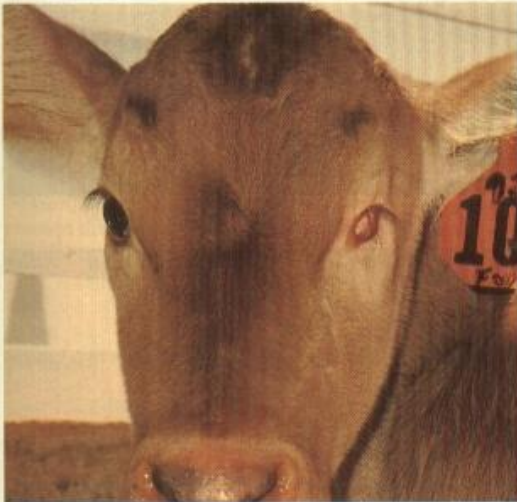
one cause. For example, congenital cataract may be inherited, or it may have been caused by maternal BVD infection during pregnancy. The cause of many abnormalities is unknown. Congenital disorders in organs other than the eye are described in Chapter 1.

Anophthalmia (anophthalmos); microphthalmia (microphthalmos)

The two examples illustrate true anophthalmia, in that there is total absence of the globe. Microphthalmia is defined as reduced dimensions of the eye. The left eye of the Guernsey heifer in **417** has a small orbit and there is no evidence of the globe. Note that the

entire orbit appears collapsed and smaller, compared with the normal right eye. The close-up of the Gloucester calf (**418**), in which both eyes were totally absent, shows an intact third eyelid and the orbit lined with conjunctiva.

417



418



411



412



413



414



Manganese deficiency

415



This Hereford neonate (415) cannot stand owing to a congenital twisting and flexion of the enlarged fetlock joints. Various other skeletal abnormalities are also present. These changes resulted from a severe manganese deficiency in the dam during gestation. In a 100-head Hereford herd in Canada, of the 5–10% of calves that were born with abnormalities, this calf was among the most severely affected. Following external splintage, many calves recovered from tendon contracture.

Phosphorus deficiency (osteomalacia)

407



408

Phosphorus deficiency is the most common mineral deficiency worldwide. Affected cattle are unthrifty, have a poor appetite and walk stiffly. The Brazilian steer in 407 is stunted, extremely emaciated, and walked with great difficulty. The local term for this severe aphosphorosis is 'entrevá'. The Brazilian Zebu (Gir) cow (408) is eating a bone, demonstrating 'pica'; other bones litter the ground. This habit may result in botulism (687). A carcass of a phosphorus-deficient animal from the Australian outback has multiple fractured ribs that are so soft they can easily be cut with a knife (409). A phosphorus deficiency in young cattle causes rickets (406) with slow growth and joint deformities. The easiest and cheapest prophylaxis is the supply of a phosphatic mineral supplement in troughs or boxes protected from the rain. *Differential diag-*



409

nosis: other mineral deficiencies, e.g., calcium, copper and cobalt, and starvation.

Copper deficiency (hypocuprosis)

The crossbred Hereford heifer in 410 is unthrifty and has enlarged fetlocks and a characteristic brownish tinge to the hair coat. The loss of hair pigment may produce a 'spectacled' appearance, as seen in the crossbred Charolais calf in 411. (The Hereford also has lice.) Bone fragility and anaemia are other clinical features. The Brazilian cows in 412 show poor growth, poor hair coat and loss of pigment. The fetlock joint enlargement (413) is due to widening and irregularity of the metacarpal physes, as seen in the radiographs (414) of an affected animal (left) compared with a normal animal (right). Similar radiographic changes are seen in the digits. Other cattle may become stunted, developing bowed legs, contracted tendons and kyphosis. Excluding phosphorus deficiency, a deficiency of copper may be the most severe



410

mineral limitation to grazing livestock in extensive tropical regions. *Differential diagnosis:* aphosphorosis(407), rickets(406), and cobalt deficiency(416).

Hyaena disease

This severely affected, three-and-a-half-year-old French Friesian cow (404) has a hyaena-like silhouette, with underdevelopment of the hindquarters. Calves are normal at birth, and manifest the initial signs of the disease at 6–10 months. Compared with a

normal tibia of a two-year-old animal (405, left), the tibia of an affected individual (22 months) is considerably shortened, although the width and articular surface area are comparable. The condition is thought to result from a bone dysplasia.

404



405

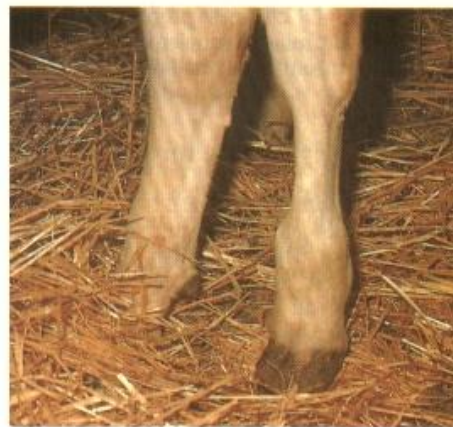


Deficiency diseases

Rickets

Rickets, caused by a calcium, phosphorus or vitamin D deficiency, involves a failure of calcification of osteoid and cartilage. Swelling and pain generally involve all the major limb joints.

In the six-month-old Holstein heifer in 406 the fetlock is enlarged due to widening of the distal metacarpal physis. The articular surfaces are normal. The calf is lame. *Differential diagnosis:* copper deficiency (413) and epiphysitis. See also spinal compression fracture (345).



406

Fescue foot gangrene

Fescue foot is caused by an ergot-like toxin, consumed by cattle grazing certain endophyte-infested strains of tall fescue grasses in many states of the USA, as well as in New Zealand, Italy and Australia.

In the 11-month-old Hereford steer in 401, the dark areas of skin on the hind pasterns are dry gangrene. A sharply-defined oblique line (A) extending over the fetlock, separates the dead from the normal skin. Skin has also separated from the coronary band to expose infected subcutis (B). The upper (right) limb shows a pink area where the gangrenous skin has sloughed. The ear tips and tail may also become gangrenous. *Differential diagnosis:* ergotism (402), frostbite (123), trauma (400) and salmonellosis (50).



401

Ergot gangrene

Gangrene of the extremities resulting from the ingestion of ergot-infested cereals and other feeds is a worldwide problem. The clinical features resemble fescue foot (401). The feet and tail tip are affected in the yearling heifer in 402. Gangrenous skin is sloughing from the left metatarsal region, and a similar line of demarcation is seen in the right leg. The distal 25 cm of the tail is twisted, moist and gangrenous.

More advanced changes in the feet are shown in 403. The left foot has almost sloughed at the pastern, and the distal third of the tail is detached. Ergotism results from ingestion of the parasitic fungus *Claviceps purpurea* on hay, grain or seeded pastures. *Differential diagnosis:* fescue foot (401), frostbite (123), trauma (400), and salmonellosis (50).

402



403

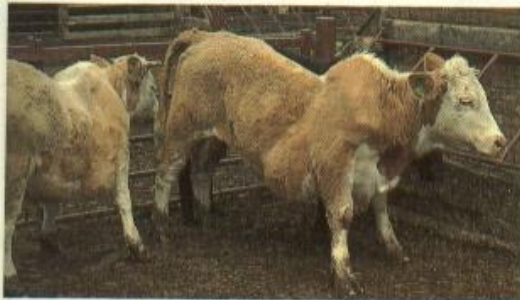


White muscle disease

In fattening beef cattle (397), in which the condition is also termed 'flying scapula', muscular dystrophy and white muscle disease resulting from a combined vitamin E and selenium deficiency, may be involved in the rupture of the same muscles as in 396. The heart of a calf with white muscle disease (398) has extensive pale greyish areas on the epicardium. This pallor typi-

cally extends into the myocardium, and there may also be endothelial plaques. The cardiac shape is globular following chronic hypertrophy. White muscle lesions are usually bilateral. They are seen in skeletal muscle and in the diaphragm, and result from peroxide-induced muscle-fibre necrosis following calcium deposition.

397



398

Foreign body around the metatarsus

In 399 a piece of wire is being removed from a characteristic, deep, circumferential, granulating wound of the metatarsal soft tissues. The two-year-old Limousin bull was moderately lame and recovered rapidly.



399

Distal limb gangrene: traumatic origin

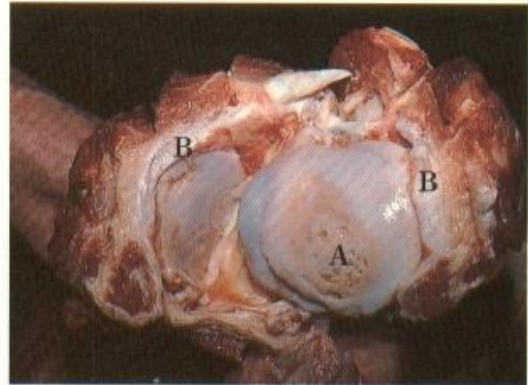
In 400 a clear line demarcates the dead from the healthy skin. The Holstein cow had caught her leg at the metacarpal level in a stanchion chain, and was found recumbent the following morning, with the chain still in place. A few days later the skin was dry and painless. It sloughed three weeks later, together with the distal soft tissues and hoof horn capsule, necessitating euthanasia.



400

Osteochondrosis dissecans (OCD)

OCD occasionally causes a degenerative and aseptic joint problem of unknown aetiology in young, fast-growing beef cattle. The opened joints of a yearling Angus crossbred steer (394) that had chronic, bilaterally enlarged shoulder joints, leading to lameness and poor growth, show loss of cartilage and subchondral bone (A), and periarticular fibrosis (B).



394

Septic myositis (popliteal abscess)

The massive swelling seen in the right thigh of this two-year-old Simmental bull (395) caused a moderate lameness. The lighter area had been clipped for exploratory puncture. The swelling contained 12 litres of pus (isolate: *Actinomyces pyogenes*). For a further discussion, see popliteal abscess (118).



395

Rupture of the ventral serrate muscle

The right scapula of the mature Flemish Maas-Rijn-Ijssel cow in 396 projects above the thoracic spine owing to the rupture of the ventral serrate and subscapular muscles. The scapula returns to its normal anatomical position when the leg is not bearing weight. In mature cattle the aetiology is probably chronic muscle degeneration and atrophy.



396

Miscellaneous locomotor conditions

Carpal hygroma

Carpal hygromata rarely reach the size seen in the right leg of this old Friesian cow (390). They are usually bilateral, contain thin serum-like material, and cause little or no lameness. Like tarsal bursitis (see 376), carpal hygromata result from repeated contusions on hard surfaces (concrete) in poorly designed housing, or from brucellosis.



390

Spastic paresis ('Elso heel')

In this six-month-old Friesian heifer (391) the left hock is overextended, and the gastrocnemius tendon and muscle were tense on palpation. This inherited condition, sporadically seen in both dairy and beef breeds, affects one or both hind limbs, producing a progressive disability that starts at 2–9 months old. Surgical correction can be performed, but is not recommended in breeding animals. *Differential diagnosis*: dorsal patellar luxation, joint ill, gonitis, localised spinal trauma or space-occupying lesion.



391

Hip dysplasia

The yearling Hereford bull in 392 has severe atrophy of the hindquarters. The forefeet are placed caudally and the hindfeet cranially to increase the proportion of weight borne by the forequarters. The acetabulum of another Hereford bull (393) shows the extensive cartilaginous erosion and areas of bone loss that result

from this degenerative process. Hip dysplasia is a progressive and probably inherited, bilateral, degenerative joint disease, seen in several beef breeds including the Aberdeen Angus and the Hereford. The clinical signs start at 2–18 months old.

392



393

Peroneal paralysis

Peroneal paralysis is a common postpartum injury. The stance of the six-year-old Holstein in 387 resulted from paralysis of the hock flexors and digital extensors. Paresis or paralysis may persist for days or weeks, or, occasionally, indefinitely. The peroneal nerve is most susceptible to damage over the lateral surface of the stifle joint, and injury with subsequent paralysis is therefore seen following recumbency on a hard surface.



387

388

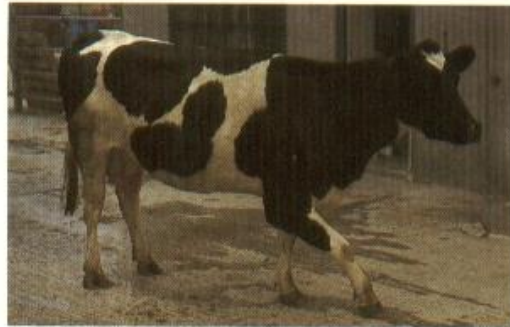


Radial paralysis

This mature Holstein cow (388) shows a dropped elbow, a flexed carpus and fetlock, and an inability to bear weight. The cow had been maintained under general anaesthesia, in right lateral recumbency on a padded table for two and a half hours. Paralysis was immediately evident on standing and the gait was normal two days later. *Differential diagnosis:* humeral fracture.

Brachial plexus injury

The elbow of the Friesian heifer in 389 was dropped, but the forelimb could be advanced for some limited weightbearing. This injury can result from severe abduction of the forelimb. Some radial paralysis (the radial nerve being one component of the plexus) was present.



389

The Ayrshire cow in 383 has a complete bilateral rupture, cannot stand, and bears weight on the plantar surfaces of the hock and metatarsus. Another form of gastrocnemius injury is traumatic transection, as shown in the two-year-old Friesian heifer in 384. This

injury arises from a slicing action and can be very severe. The wound is invariably infected. Since both gastrocnemius and superficial flexor tendons are involved, weightbearing is made impossible.

383



384

Peripheral paralyses

One form of peripheral paralysis (obturator) has already been illustrated in the context of the downer cow syndrome (342). The four other types of nerve

damage, that are illustrated below, do not often result in this syndrome.

Sciatic paralysis

Left sciatic paralysis resulted from the accidental (iatrogenic) perineural injection of an antibiotic solution into the deep gluteal region of this Angus heifer (385). Long-acting antibiotic preparations are commonly implicated. Sciatic paralysis occasionally develops following prolonged recumbency resulting from parturient paresis. Severe ischaemic muscle necrosis is evident around the damaged nerve (see downer cow, p.106).



385

Femoral paralysis

The flexed stifle cannot be extended to allow weightbearing, owing to dysfunction of the quadriceps group in this four-day-old Simmental calf (386). Skin sensation was absent over part of the medial aspect of the thigh. A secondary lateral patellar luxation is sometimes present (360). A hollowed-out appearance of the quadriceps muscle (atrophy) is seen after about 7–10 days. Neonatal cases are the most common and their pathogenesis is often unclear. Foetal hyperextension caused by excessive traction during delivery, muscular compression and ischaemic anoxia may account for the clinical signs.



386

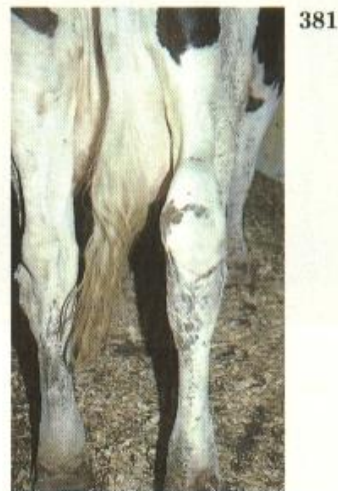
Medial tarsal hygroma

The bilateral swelling in **380** is fluctuating, painless, and causes only slight mechanical lameness from its size. The condition is uncommon and the aetiology is unknown.



Tenosynovitis of the tarsal sheath ('capped hock')

A firm swelling surrounds the point of the hock of this three-year-old Holstein cow (**381**) and extends distally towards the tibiotarsal joint. Six months previously, the cow had fallen through a metal grid, sustaining an open wound involving the medial aspect of the tarsal sheath. Sepsis resulted, but the wound eventually healed with fibrosis.



Gastrocnemius trauma

Trauma to the gastrocnemius muscle-tendon group arises sporadically from struggling, as when a cow with hypocalcaemia (milk fever) attempts to stand following a period of recumbency. Rare cases are associated with vitamin D deficiency and aphosphorosis. The prognosis is generally hopeless, except in young animals, where external support may permit slow healing by fibrosis. Two manifestations of gastrocnemius rupture are shown. The first (**382**) shows a dropped hock and swelling of the gastrocnemius muscle belly in a Shorthorn heifer.



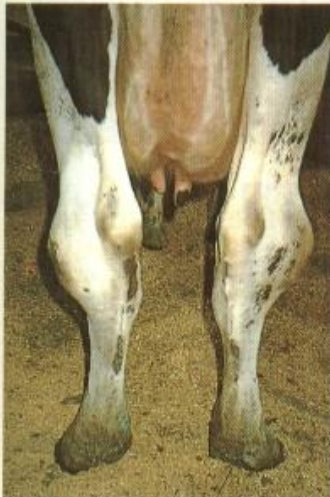
Conditions of the hock region

Hock trauma is commonly seen in confinement housing systems with inadequate bedding, and especially when the cubicle/free-stall size and design are deficient. Solid, horizontal, wooden dividing rails and vertical uprights often cause injuries. Trauma may also

develop secondary to digital lameness, when cows are recumbent for long periods and have difficulty in rising. Many forms of hock swelling and injury cause little or no lameness.

Tarsal bursitis and cellulitis

376



377



378



Lateral swellings over the subcutaneous bursae of both hocks (also called cellulitis) are common in cattle housed on concrete (376). Carpal hygroma (390) causes a similar foreleg problem. The hair loss results from chronic abrasion. A horizontal section through an affected hock (377) shows a discrete discoloured cavity (A) lined with granulation tissue. The synovia-like fluid is sterile. The majority of cases are not infected. An outward deviation of the digits (cow-hocked) often contributes to the development of tarsal bursitis.

Occasionally, the skin barrier is broken and the wound becomes infected and discharges pus (378). The swelling then tends to be more diffuse than in aseptic bursitis, and marked pain and lameness result. In another cow the left hock is very swollen and an area on the plantar surface is necrotic and septic (379). The injury resulted from a puncture wound which introduced infection into the subcutaneous tissues. Although such affected animals do become very lame, this animal recovered after antibiotic therapy.



379

Septic arthritis of the fetlock, and tenosynovitis

The four-month-old calf in 371 has a wound (not visible) on the medial surface of the fetlock, severe septic cellulitis, tenosynovitis and arthritis leading to massive joint swelling. The fetlock joint of the Friesian cow in 372 (with flexor tendons reflected) contains inspissated pus (*Actinomyces pyogenes*), but has minimal damage to the articular cartilage. In such cases, joint infection often results from ascending digital

sepsis. The longitudinal section of the metacarpus of a seven-week-old Angus heifer (373) shows skin necrosis, and infection has led to sepsis of the metacarpophalangeal (fetlock) joint. The skin necrosis had developed from overlong application of splints and a plaster cast (four weeks) for the immobilisation of a midshaft metacarpal fracture (A), which is seen to have healed.

371



372



373



Septic arthritis of the elbow

In the 14-month-old Holstein heifer in 374, brownish pus adheres to the joint surfaces. The articular surfaces, especially of the distal humerus, are severely eroded (A). Periarticular fibrosis is present. The usual age range for septic arthritis in calves is 1–3 months.

Chronic infectious gonitis

This old cow from Czechoslovakia (375) had lost a lot of weight and was in obvious pain. Long-standing degenerative and proliferative changes had caused considerable enlargement of the stifle joint. *Brucella abortus* was recovered from the synovial fluid.

374



375

Epiphyseal separation and metacarpal fracture

The radiograph (367) shows a partial separation and displacement of the distal metacarpal growth plate (A), and fracture of the metaphysis (B) (Salter type II) in a neonatal calf.



367

Infectious arthritis

Septic arthritis and epiphysitis

This section excludes joint ill and polyarthritis of calf-hood (see 65 in the neonatal chapter). Most forms of septic or infectious arthritis are bacterial in origin. They originate from penetrating wounds, extension

from adjacent tissues (both forms being common in digital sepsis, see p.93), or by the haematogenous route.

Septic carpalitis

Pressure necrosis of the skin over the carpus (knee) in a four-month-old Holstein heifer (368) has exposed the carpal bones. Note the peripheral epithelialisation and necrosis. A lateral radiograph of the flexed carpus (369) shows soft tissue swelling, bone destruction of

the middle and distal rows of carpal bones, and an extensive osseous proliferative reaction (A). A sagittal section through the limb (370) confirms the massive tissue destruction. Infection also extends along the tendon sheaths.

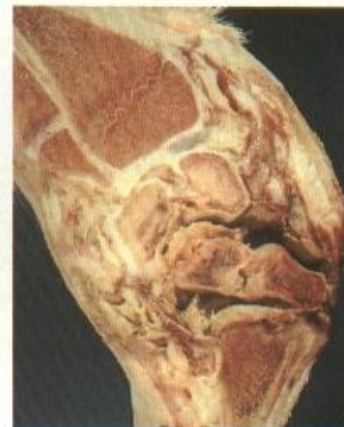
368



369



370



Aseptic gonitis

Aseptic or noninfectious gonitis results from trauma, and animals experience a severe and chronic lameness. The swelling in the yearling Friesian (362) comprises fibrosis and inflammatory fluid around the joint with secondary bone proliferation. Typically, young cattle may have a partial rupture of a collateral ligament. Some cases remain slightly lame owing to a degenerative osteoarthritis. In mature cattle (363) cranial cruciate ligament rupture (CrCL) is a common cause of severe stifle lameness (ruptured ligament (A)). A lateral radiograph (364) of the stifle joint of a similar, old, beef cow shows considerable cranial

movement of the tibial articular surface on the femoral condyles (about 3 cm). A small chip is evident near the tibial eminence (A). The cranial view into the opened stifle joint in 363 shows a mere fragment of the CrCL (A), although the caudal cruciate ligament is intact (B). The medial meniscus is torn and fragmented. The medial femoral condyle shows bone loss from erosion (C), and the margin of the condyle has extensive osteophyte proliferation (D). The palpably thickened joint capsule and bony enlargement are prominent clinical signs of CrCL.

362



363



364



Metacarpal fractures

365



366



The Friesian calf in 365 had severe angulation following a recent distal metacarpal shaft fracture. The small amount of overlying soft tissue makes such fractures liable to perforate through the skin and become infected, hence producing osteomyelitis. Such fractures, or separation of the metacarpal physis, are very likely to occur following excessive traction in dystocia. The bilateral metacarpal shaft fractures in the Angus heifer in 366 were caused by traction on obstetrical chains placed just above the fetlocks. Note the residual scar. In this view, healing was taking place two weeks after external splintage, but note the 10–20° malalignment.

Femoral fracture

The soft tissue swelling in this Simmental bull calf (358) overlies a femoral shaft fracture that had occurred two days previously. The stance could be confused with femoral paralysis or a hip injury such as coxofemoral luxation or femoral neck fracture. Other femoral fractures are shown in 340 & 341.



358

Patellar luxation

Patellar luxation may be upward or lateral, the respective clinical signs differing markedly. The right hind leg of the Holstein heifer in 359 was held in maximal extension for a few seconds and was then jerked forward. The patella was temporarily fixed above the femoral trochlea. Diagnosis (upward patellar fixation) is confirmed by the response to medial patellar desmotomy. One specific form of upward luxation and fixation occurs in growing and mature cattle, and is common among draught animals in the Indian subcontinent.

Some forms are inherited. *Differential diagnosis:* spastic paresis (391).

The young Holstein calf (360) had a flexed stifle. The patella was easily palpable, and luxated lateral to the femoral trochlea, increasing the total width of the joint. Note the accompanying gross quadriceps femoris atrophy and left hind plantigrade stance. Lateral patellar luxation is largely confined to calves less than one month old. *Differential diagnosis:* femoral paralysis (386).

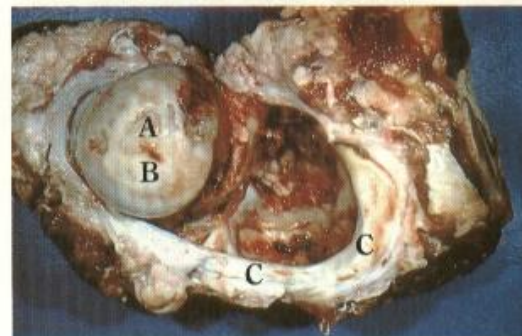
359



360

Degenerative hip arthritis

Degenerative joint disease (DJD) affects the hip and stifle more frequently than other weight-bearing joints. This hip joint of an old Hereford cow (361) shows the classical features of DJD: extensive erosion of articular cartilage (A), eburnation of the underlying bone (B), and a thickened joint capsule (C). The presence of blood suggests that a more recent traumatic incident had occurred after the chronic changes became established.



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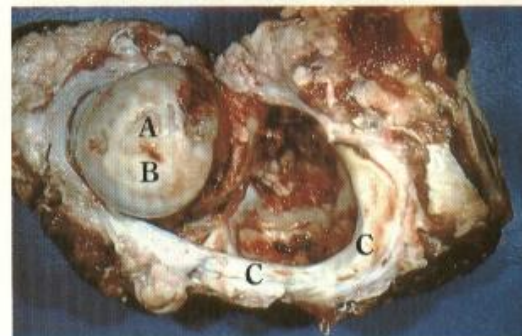


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361

Tail paralysis

This Hereford bull (353) could not raise his tail to defecate. The prominent swelling at the tailhead (A) is an old sacrococcygeal fracture. It resulted from a fall during an attempted service of a cow, and led to compression of the coccygeal nerve supply. However, sacrococcygeal fracture does not invariably lead to nerve

dysfunction, but simply to minor disfigurement, as in the two-year-old Guernsey heifer in 354. The growing animal is especially susceptible to compression fractures of the spine and to localisation of metastatic septic foci in the growth plates of vertebral bodies.

353



354



Pelvic fracture

355



356



357



An open fracture of the left ilial wing of the cow in 355 is grossly contaminated. Such fractures arise from trauma incurred in overcrowding, when passing through doorways, or from a sudden fall on a hard surface. Most fractures of the ilial wing are closed, the fragment of bone being pulled downwards by the fascia lata, as in this Guernsey cow (356), where the bony prominence is absent ('dropped hip') on the right side. In other cases, the skin over the bone becomes gangrenous and sloughs (357). Most ilial wing fractures are nothing more than cosmetic blemishes. In contrast, ilial shaft and pubic fractures often cause severe lameness and sometimes recumbency.

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Spinal spondylitis

The cow in 350 has an arched thoracolumbar spine and the hind feet are placed further to the rear than normal. The right hind foot is lifted in an attempt to relieve spinal pain. Such cows often 'paddle' with the hind legs and have difficulty in rising. The condition (compare lumbar spondylosis (336) and spinal osteomyelitis (348) is a slowly progressive, aseptic process. Proliferating bone on the spinal bodies may eventually produce ankylosis (337).



350

351



Cervical spinal fracture

A fracture of the fifth and sixth cervical vertebrae made the two-year-old Friesian heifer in 351 unable to lift the head and neck. A prominent dip is apparent in the dorsal cervical spine, in front of the scapula.

Sacroiliac subluxation

The wings of the ilium in the Friesian cow (352) are raised relative to the lumbar spine. Rectal palpation revealed the sacral promontory to be pushed backwards and depressed, resulting in a reduced dorsoventral diameter of the pelvic inlet. Subluxation occurs sporadically in cows immediately postpartum, and generally following dystocia, when it can cause temporary recumbency, the downer cow syndrome (p.106). In contrast, complete luxation (with no persisting contact of the sacrum with the ilial wings) has a poor prognosis for recovery to normal stance and locomotion. Affected cows should not be retained for breeding as the reduced pelvic inlet predisposes to dystocia.



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352

Fluorosis

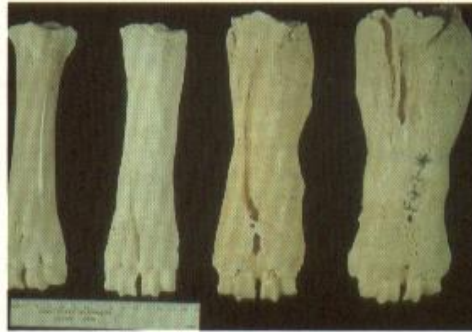
Fluorosis usually results from the prolonged ingestion of fluorine in high fluorine-phosphatic supplementary feeds, or from herbage ingested from pastures contaminated by industrial emissions. Large periosteal plaques form on long bones. **727** shows several enlargements that are firm and smooth to the touch on the medial aspects of the metatarsi. In **728** the extensive periosteal plaques, which do not involve the artic-

ular surfaces, are seen next to normal metatarsi (to the left). Cattle may become lame owing to osteoporosis and periarticular bone proliferation. Another sign of chronic disease is mottling of the temporary incisors (see **154**). *Differential diagnosis:* degenerative joint disease (**361**), a phosphorus (**407**) and selenium (**716**).

727

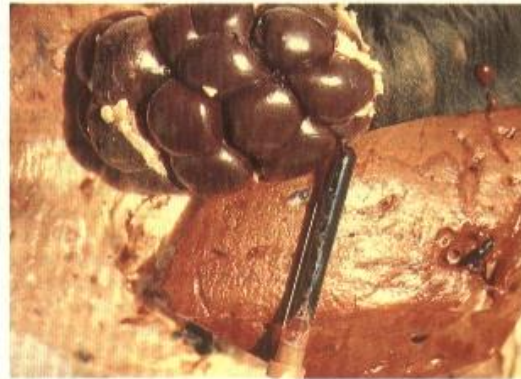


728



Copper

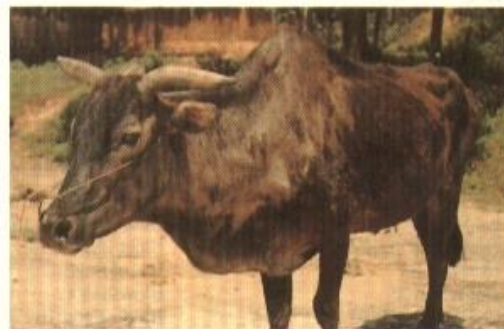
Copper toxicosis in cattle tends to be chronic, although the onset of clinical signs may be acute and associated with stress. The source may be an error of copper supplementation, or ingestion of pasture with an abnormal level of copper (from slurry or fertiliser top-dressing). Affected animals have dark urine due to haemoglobinuria. The major postmortem changes include a large, friable, icteric liver and a characteristic bluish-black ('gunmetal') colouring of the kidneys (**729**).



729

Molybdenum

Molybdenum toxicosis tends to involve a relative copper deficiency. The cow from China (**730**) is thin and shows depigmentation of the normally dark coat. Note the greyish hairs around the eyes. Alopecia is present over the neck, shoulder and withers. Note the combination halter and nose-ring used in Jiangxi Province. Many cattle with molybdenum toxicity show a persistent diarrhoea. This is typical of the high-molybdenum 'teart' pastures in parts of England. Cattle respond to copper supplementation. *Differential diagnosis:* copper deficiency (**410**) and cobalt deficiency (**416**).



730

Carbamate and organophosphorus

Since the toxic signs of carbamate and organophosphorus tend to be similar, both of these organic groups can be discussed together.

The crossbred Angus cow in **723** had ingested a carbamate insecticide powder (carbofuran or 'Furadan') from a half-empty bag about 6–16 hours previously. Initial generalised muscle twitching, depression and locomotor incoordination were accompanied by hypersalivation. The cow then became semicomatose. Still salivating profusely, she showed miosis, severe dyspnoea and pronounced bradycardia, and died two hours later. The calf was healthy throughout. The clinical signs relate to the accumulation of acetylcho-



723

line and the resultant parasympathetic stimulation. *Differential diagnosis:* nitrate and cyanide poisoning (**724**), acute grain overload (**175**) and urea toxicity.

Inorganic chemical toxicoses

Nitrate/nitrite

Nitrates form nitrites before or after ingestion and cause respiratory distress because methaemoglobin formation leads to an anoxic anaemia. The sources of nitrate/nitrite are numerous and variable in type, and include cereals, specific plants, and both organic and inorganic fertilisers. A characteristic feature of this type of poisoning is the colour change in the vaginal

mucosa. Levels of 22% (**724**) and 60% (**725**) met haemoglobin are illustrated. Clinical signs appear at a level of about 20% conversion of haemoglobin to methaemoglobin, while death follows at 60–80%. *Differential diagnosis:* silo gas poisoning, sodium chlorate poisoning, acute rape or kale toxicity (**707**), and cyanide, carbon dioxide, cobalt or chronic copper poisoning (**729**).

724



725

Lead

In lead poisoning the major signs of central nervous system (CNS) involvement are depression, blindness and, often, head-pressing. The one-month-old Gloucester calf in **726** shows severe CNS signs. Unable to stand, its head and neck are extended to push against the brick wall. It was also blind and anorexic. Lead is a common toxicological problem in younger cattle. The source is often paint from old doors, as in this calf, although crankcase oil from farm machinery, lead batteries, contaminated feedstuffs and golf balls are other sources. *Differential diagnosis:* polioencephalomalacia (CCN) (**451**), listeriosis (**459**) and meningitis (**465**).



726

A late stage of facial eczema (720) shows a Friesian heifer with an extensive skin slough, typically confined to the white areas. Note the involvement of the forelimbs (A), where carpal flexion has caused sloughing, and the thickened, wrinkled appearance of the skin extending down the hind legs (B). In a Brazilian Zebu herd, a one-month-old male calf (721) had an extensive photodermatitis involving the ventral neck fold and chest wall and flank. The same fungus, *Pitho-*

myces chartarum, was consumed by the dam from a pasture of *Brachiaria decubens*, sporidesmin being ingested through the milk. *Differential diagnosis:* other forms of photodermatitis.

Other examples of mycotoxicosis are illustrated in the locomotor section (fescue foot, 401; ergot, 402 & 403). Photosensitisation is covered in Chapter 3 (70-75).

720



721

Organic toxicoses

Chlorinated naphthalenes

Naphthalenes were formerly extensively used as lubricants and wood-preserving compounds. They are compounds that cause hypovitaminosis A by interfering with the conversion of carotene to vitamin A. Hyperkeratosis of skin, emaciation, and possibly death, result when they are ingested over a long period. In 722 the head of the South African Friesian cow shows thickening, scaliness and wrinkling of skin. The hindquarters also had severe changes over the gaskin, hock, and metatarsus.



722

Lupine toxicity (crooked calf disease)

Deformed calves, with variable degrees of malalignment of the long bones, are born to cows that have ingested large quantities of certain species of lupine plants (e.g., *Lupinus caudatus*) during pregnancy. The calves in 718 were born to cows fed lupines from the

fortieth to the seventieth day of gestation. Lupine species can also cause liver toxicity. See Chapter 1 (12) for other forms of arthrogryposis (e.g., BVD/MD virus infection).



718

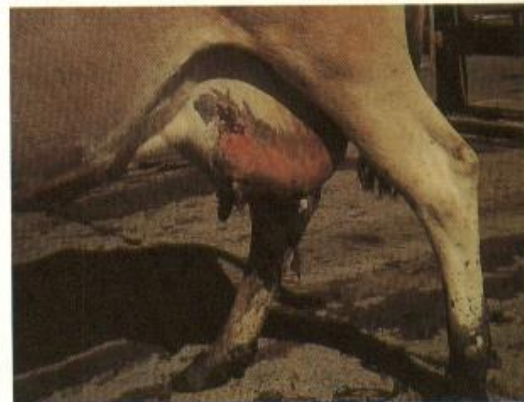
Mycotoxicoses

Mycotoxicosis is a poisoning due to the ingestion of a fungal toxin. One or more systems may be affected,

but the photodermatitis associated with the fungus *Pithomyces chartarum* is the selected example.

Facial eczema

In facial eczema, an important disease in New Zealand, but also seen to a limited extent elsewhere, the fungus *Pithomyces chartarum* produces a hepatotoxic agent, sporidesmin. The fungus is commonly associated with ryegrass pastures. The clinical signs include lethargy, anorexia, jaundice and a photosensitive dermatitis. At an early stage, the thin skin of the udder of the Jersey cow in 719 had lost its hair, and a moist dermatitis and hyperaemia were evident. The skin in the upper left denuded area was starting to slough and the teats were also involved. Affected cows may lick this area of mild chronic irritation.



719

Tetrapteryx species (*peito inchado*)

Tetrapteryx species (*T. multiglandulosa* and *T. acutifolia*) cause a widespread cardiovascular disease in southeastern Brazil. Cattle develop ventral, especially brisket oedema (hence *peito inchado* or swollen breast), jugular venous distension and cardiac arrhythmia, as seen in the five-year-old crossbred Zebu cow in 714). The disease, usually subacute, is sometimes

chronic, but rarely peracute. Postmortem lesions include myocardial pallor with some whitish streaking, and increased firmness suggestive of fibrosis, as seen in another mature Zebu cow in 715. *Tetrapteryx* poisoning has been reproduced by feeding fresh or dry plant material for 9-50 days. The same plant may be responsible for stillbirths.

714



715

Selenium toxicity (locoweed, selenosis)

In 716 the extremely emaciated cow has extensive hair loss over the trunk, and claw deformities, resulting from prolonged ingestion of excessive selenium incorporated in *Astragalus* species, which are selenium accumulator plants. A horizontal band starts below the coronary band and moves slowly distally. Pain,

producing severe lameness, results from the movement of wall horn over the exposed sensitive laminae (717). Affected cattle may be forced to graze in a kneeling position. Other toxins can also contribute to the clinical picture.

716



717

Lantana

Lantana camara is a shrub that causes hepatitis in cattle, producing signs of photosensitisation, jaundice, rumen stasis and depression. In 710 the Holstein steer from Zimbabwe shows severe skin lesions (typical of photosensitisation in that only the white areas are affected), depression, and tenesmus resulting from constipation. See also Chapter 3, photosensitisation p.30, and facial eczema p.214.



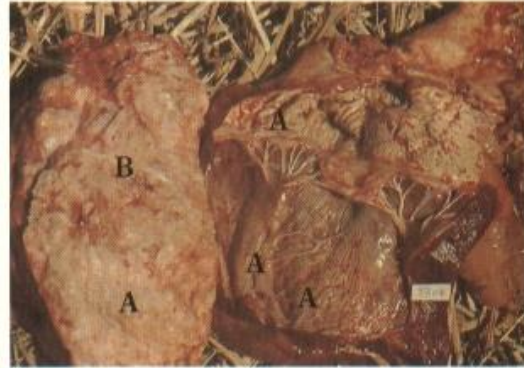
710

Solanum malacoxylon and *Trisetum flavescens* (enzootic calcinosis, *enteque seco, espichamento*)

In 711 the crossbred cow from Mato Grosso, Brazil is typically emaciated, stiff and stands on the toes of the forefeet. The endocardium and lungs of another cow (712) have areas of calcification (A), and the lungs have patches of ossified tissue (B). *Solanum malacoxylon* (South America) or *Trisetum flavescens* (Bavaria) acts by increasing calcium absorption from the gut through a metabolite of 1,25-dihydroxycholecalciferol, the active principle of vitamin D. It leads to excessive deposition of periosteal new bone and to calcifica-

tion of blood vessels, which may be appreciated on rectal palpation (aorta) and on the lower limb (distal arteries). Calcification of the deep flexor tendons and blood vessels is present in this German cow with *T. flavescens* toxicity in 713. Other *Solanum* species cause cerebellar degeneration in Africa. The nightshade group (e.g., *Solanum nigrum*, deadly nightshade) can produce gastrointestinal irritation and nervous signs.

711



712



713

Yew

The opened rumen in **705** shows normal ingesta mixed with yew leaves. Yew (e.g., *Taxus baccata* – English yew, *T. cuspidata* – Japanese yew) contains a cardiotoxic alkaloid, taxine. Cattle usually die minutes after ingesting a few mouthfuls of yew twigs or berries, typically encountered as fresh or dried clippings thrown over a graveyard hedge into a bare winter pasture. The lethal dose in adult cattle may be as little as 1 kg of leaves.



705

Ragwort

Ragwort (*Senecio jacobea*) contains a pyrrolizidine alkaloid, jacobine, that causes acute and chronic liver disease. Early signs include dark-coloured diarrhoea, photosensitisation, jaundice and central nervous system abnormalities. Prolonged ingestion results in liver failure due to cirrhosis, and severe lung disease. In the mature Hereford cow in **706**, the resulting right heart failure led to the ventral oedema affecting the ventral body wall, brisket and head.



706

Rape and kale

707



708

709



Some forms of forage of the *Brassica* family, such as kale and rape, contain S-methylcysteine sulphoxide, and can cause a haemolytic (Heinz body) anaemia following production of dimethyl disulphide by ruminal bacteria. Cattle develop haemoglobinuria, voiding dark-red urine (**707**), and are anaemic and weak. Post-mortem examination of fatal cases reveals pallor and jaundice of the liver (**708**) and heart (**709**). *Differential diagnosis*: postparturient haemoglobinuria, bacillary haemoglobinuria (**213**), nitrate/nitrite poisoning (**724** & **725**), hypomagnesaemia (**454**), babesiosis (**655–660**), anaplasmosis (**661–664**) and acute bracken poisoning (**698–700**).

Ingestion of considerable quantities of bracken for several months can lead to a chronic syndrome. A carcinogen causes bladder neoplasia, resulting in enzootic haematuria and malignancies such as haemangiosarcoma (701). Numerous discrete masses are seen protruding from the mucosal surface. These bleed readily as the bladder distends and contracts. Some areas of mucosa (top right, lower left) appear normal. The haemangiomas can develop into ulcer-

ating tumours of various types. Alimentary tract neoplasms include squamous cell carcinomas and papillomas affecting the pharynx and oesophagus respectively. 702 shows pharyngeal squamous cell carcinomas (A) and oesophageal papillomas (B) from Brazil. Bracken toxicosis is widespread in several continents. A viral papilloma may be involved in upper alimentary neoplasms.

701



702



Oak (acorn)

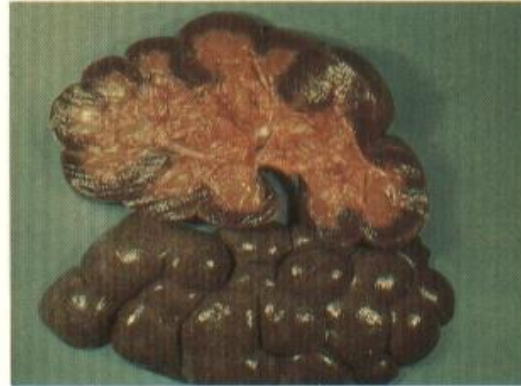
Oak (*Quercus* species) may cause toxic signs following several days ingestion of acorns (autumn) or young leaves (spring). The toxic principle, a gallotannin, causes renal and gastrointestinal changes. The signs include abdominal pain, thirst, polyuria and ventral oedema as a result of subacute and chronic toxic-

ity. The oesophageal mucosa can be haemorrhagic (703). The enlarged swollen kidneys in 704 show scattered haemorrhages and a nephrosis, which accounts for the ventral oedema, ascites and hydrothorax seen in cases with renal failure.

703



704



13 Toxicological disorders

Introduction

Illustrations of toxicological disorders in cattle present problems. The clinical signs may be transient, with death occurring within a few minutes, such as in yew (*Taxus baccata*) poisoning. In other cases, the signs may be nonspecific. Where the effects are confined largely to one system, the description has been

given in the appropriate section, for example, ergot and fescue foot are dealt with under locomotor disorders (401–403). In this section, toxicoses have been broadly grouped into plant, organic and inorganic chemical sections.

Plant toxicoses

Bracken (bracken fern)

Bracken (*Pteridium aquilinum*) is usually a cumulative poison, acting in two ways. After ingesting large quantities for a few weeks, cattle may show an acute syndrome resulting from aplastic anaemia and thrombocytopenia. In 698 the vulva of the crossbred Angus cow is pale from severe anaemia. The pinpoint haemorrhages are a result of thrombocytopenia. Haemorrhages elsewhere can cause epistaxis, hyphaema (699) (bleeding into the anterior chamber) or haematuria from bladder mucosal haemorrhage (700).



698

699



700

Enzootic (adult) bovine leukosis (EBL)

Enzootic bovine leukosis produces a generalised lymphadenopathy with symmetrical enlargement of most peripheral nodes, often with other signs. The Angus cow in **696** had enlarged submandibular, parotid (shaved for needle biopsy before photography) and prescapular nodes. Lymphosarcoma was also found in the heart and uterus. Some cases (20%) have a predilection, usually unilateral, for the orbit. The

neoplasia is generally retrobulbar. Exceptionally, the adult cow in **697** has massive bilateral exophthalmos and protrusion of granulation tissue as a result of lymphomatous infiltration into the orbit. Other sites of lymphosarcoma include the globe itself (**449**), the spinal canal and cord, causing progressive posterior paresis as a result of spinal cord compression (**334**), and the abomasum (**196**).

696



697



Thymic lymphosarcoma

A large, firm, smooth mass is present in the presternal region of the yearling Guernsey heifer in **692**. Oedema is also present. Most cases are seen in the 6–24 months age group. Generalised lymphadenopathy was

absent. As in the multicentric form, a cross-section (**693**) of the discrete tumour from a 15-month-old crossbred Angus reveals pale yellow material without granulomatous contents.

692



693

Skin lymphosarcoma

Skin leukosis is rare and is seen in immature animals aged 6–24 months. The crossbred Hereford in **694** has grey-white nodules over the neck, back and flanks, which extend deep into the subcutis. There is also a generalised lymphadenopathy with prominent

precural nodes. In **695** another animal has skin leukosis limited to large, ulcerated lesions around the head. *Differential diagnosis:* actinobacillosis (**161**), actinomycosis (**162**).

694



695

In 689 the Zebu cow had locomotor muscle weakness, paralysis of the head muscles and tongue prolapse. Other cows appear dull and may salivate profusely. Saliva may contain partially masticated feed material which cannot be swallowed (690). In some countries the major cause of botulism is the ingestion of decomposed animal carcasses. This depraved appe-

tite (pica) is stimulated by a phosphorus deficiency (407 & 408). Up to three per cent of cattle in endemic areas may die from botulism annually. Poultry litter utilised as cattle feed has also been implicated as a clostridial source. *Differential diagnosis:* organophosphorus toxicity (723), thromboembolic meningoencephalitis (471), BSE (483), SBE (672), and trauma.

689



690



Miscellaneous

Bovine leukosis (bovine viral leukosis, bovine lymphosarcoma)

Leukosis occurs in four forms. The calfhood, thymic and skin types are all termed sporadic leukosis. The fourth type, the adult form, is known as enzootic

bovine leukosis (EBL) and is caused by the bovine leukosis virus (BLV).

Calfhood multicentric lymphosarcoma

The calf in 691 showed generalised lymphadenopathy with gross enlargement of the prescapular node. The submandibular, parotid and retropharyngeal nodes were also symmetrically enlarged. Palpation revealed that the lymph nodes were smooth, painless and freely moveable, not involving the skin. Like other forms of bovine leukosis, calfhood leukosis has a low and sporadic incidence.



691

Tetanus (*Clostridium tetani*, 'lockjaw')

Introduced into deep, anaerobic skin wounds (e.g., castration, 526), *Cl. tetani* causes progressive nervous signs as a result of neurotoxin production. Cattle show a generalised stiffness. The Jersey heifer in 685 has an extended head and neck, with the ears flattened back, and a raised tail. The nostrils may be dilated, and the third eyelid prolapsed. The disease progresses into severe extensor rigidity (686) with progressive

respiratory failure. Note the severe opisthotonos. The rigidity is so severe that the upper feet remain off the ground. The tail is over-extended. The calf had been castrated two weeks previously. *Differential diagnosis* (in early cases): meningitis (465), cerebrocortical necrosis or polioencephalomalacia (451) hypomagnesaemic tetany in calves (453), and acute muscle dystrophy (397).

685



686



Botulism (*Clostridium botulinum*)

687



A rapidly fatal motor paralysis, caused by a *Cl. botulinum* neurotoxin (usually type D), results in initial posterior ataxia and progresses to paraparesis (687). The stance may be straddled (base-wide) and the hind fetlocks may be knuckled. Motor paralysis of the tongue (688) causes difficulty in prehension, chewing and swallowing. This cow could not hold its head up.

688



Clostridial diseases

Clostridia are natural inhabitants of the soil and of the gastrointestinal tract of man and animals. Pathogenic effects in cattle arise either from ingestion or from wound contamination. One group of clostridia produces disease by active invasion and toxin production leading to death (gas gangrene), the second produces toxins within the gut (enterotoxaemia), or in food or

carriion outside the body (botulism). One clostridial disease, malignant oedema, is illustrated in the alimentary chapter (165 & 166) to aid in differential diagnosis from other conditions leading to swelling of the head. A range of combined clostridial vaccines is widely available and very effective in preventing disease.

Blackleg (*Clostridium chauvoei*)

Caused by *Cl. chauvoei*, blackleg develops spontaneously without a history of open wounds, although bruising may be a predisposing factor by producing anaerobic conditions in muscles that are harbouring the organism. Most cases end fatally after signs of acute depression and lameness. A carcass (683) may have extensive areas of darkened musculature. The

hindquarters may have the most severe changes, including infiltration of the musculature with gas bubbles that have a characteristic rancid smell. Often, severely affected muscle (dark) lies adjacent to normal tissue (684). *Differential diagnosis*: malignant oedema (166).

683



684

Trypanosomiasis

Of all animal diseases, the most important constraint on cattle production in the subhumid and humid tropics is trypanosomiasis, which in Africa alone affects animals in an area one third larger than the continental United States. Annual losses may be as high as US\$50 billion. The disease also occurs in parts of Asia and in South America. A typical severely emaciated and anaemic N'Dama cow with *Trypanosoma vivax* infection in Mali is shown in 680.

Since 1974, several major international efforts have been launched to control trypanosomiasis. Following unsuccessful attempts to use sterile male

tsetse flies for breeding, as well as insecticides and chemotherapy, the tsetse fly control has concentrated on the installation of impregnated traps and screens. Furthermore, investigation of the phenomenon of trypanotolerance exhibited by several West and Central African cattle breeds, including the N'Dama, has been promising. The gross postmortem findings are variable and nonspecific, including enlargement of the lymph nodes and spleen (681), serous atrophy of fat, and anaemia. Confirmation depends on microscopic demonstration of trypanosomes in blood smears.

680



681



Bacterial diseases

Anthrax (splenic fever)

The characteristic feature of anthrax, seen clinically as sudden death in a previously healthy individual, is an enlarged, dark, soft-textured spleen, as seen in 682 in the specimen from a crossbred Hereford cow in Zimbabwe. The cause is *Bacillus anthracis*. Cattle suspected as possible anthrax cases should not undergo postmortem examination, and diagnosis should be based initially on a blood smear. Cattle may be infected through contaminated pastures (e.g., those flooded sporadically with river water carrying tannery effluent), or by eating contaminated artificial or natural feedstuffs. A vaccine is available.



682

Jembrana disease

676



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678



Characterised by a high mortality, and probably caused by an *Ehrlichia* carried by a *Boophilus* tick, Jembrana disease presents with clinical signs of pyrexia, marked lymphadenopathy (676), diarrhoea and haemorrhages. The cow (from Southern Africa) shows enlargement of the parotid (A), retropharyngeal (B) and pre-scapular nodes (C). The faeces may contain blood derived from intestinal mucosal haemorrhage (677). Postmortem examination reveals erosions on the hard and soft palates (678). *Differential diagnosis*: rinderpest (634).

Bali disease

Bali disease is a rickettsial limited to cattle on the Indonesian island of Bali. The characteristic sign is a peripheral necrosis of the ears (679), resulting from a generalised vasculitis. The clinical disease is probably related to Jembrana disease in Africa.



679

Ondiri disease (bovine petechial fever, ehrlichiosis)

One characteristic feature of Ondiri disease is petechiation of mucosal surfaces, shown as haemorrhages beneath the tongue (673), on the epicardium (674) and in an affected lymph node (675), which is compared with a normal node. The severity of clinical infection varies considerably. The cardiac changes (674)

are particularly severe, frequently leading to fatalities. The cause is a rickettsia-like organism, *Ehrlichia (Cytoecetes) ondiri*, which is present in circulating granulocytes and monocytes during the clinical syndrome, and later localises in the spleen and other organs. The disease is confined to altitudes above 1500m in Kenya.

673



674



675



Sweating sickness

Sweating sickness is seen in Central and Southern Africa and India. The aetiology involves a toxin, produced by the female *Hyalomma truncatum* tick when she weighs 20–50 mg, resulting in toxicosis. As in the Friesian calf from Zimbabwe (670), the tick must feed for 5–7 days before sufficient toxin has passed into the host to produce clinical signs. The moist dermatitis (sweat) typically affects the inguinal, the perineum

and the axilla, producing a sour smell. Note the early myiasis ventral to the vulva. Young calves are usually affected and immunity lasts for 4–5 years. Hair loss, which may be total, occurs secondary to the initial moist dermatitis. Hair may be pulled off when the animal is handled, for example over the ears (671). Lacrimation and salivation may occur because all mucous membranes are affected.

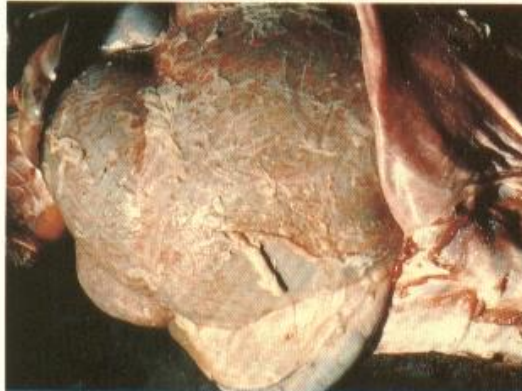
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671

Sporadic bovine encephalomyelitis (SBE, 'buss disease')

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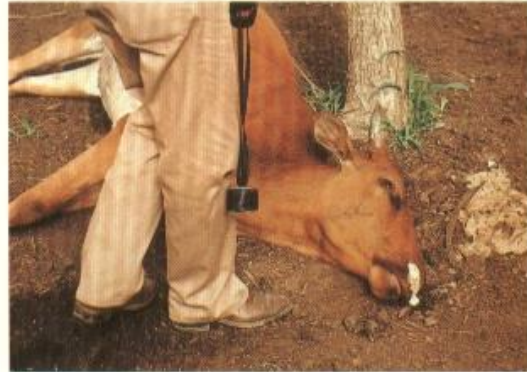
Sporadic bovine encephalomyelitis is an uncommon systemic infection, caused by *Chlamydia psittaci*. A paramyxoviral SBE, recently described, is a separate entity. Also known as transmissible necrosis, it has a worldwide distribution and causes a generalised inflammation of blood vessels, serous membranes and synoviae. The calf in 672 shows a chronic fibrinous exudative peritonitis. Pleurisy and pericarditis were also present.

Cowdriosis ('heartwater')

Caused by the rickettsial organism, *Cowdria ruminatum*, heartwater is transmitted from reservoir hosts (e.g., wildebeest) to susceptible cattle by *Amblyomma* (bont) ticks, producing severe damage to the vascular endothelium. The disease is common in many parts of Africa and the Caribbean; the cattle illustrated are from Mali. Peracute disease produces rapid death. Acute cases are initially dull, pyrexic and anorexic, with a 'tucked up' abdomen, as seen in the

Zebu steer in 666. Nervous signs, convulsions, maniacal behaviour and death in extensor spasm may follow rapidly, with a frothy discharge from the nostrils (667). Increased vascular permeability produces a generalised circulatory failure, seen as lung congestion, hydrothorax and hydropericardium (668, where the forceps raise the margin of the incised pericardium). In 669 the cut surface of an affected lung shows massive interlobular oedema (A) and congestion (B).

666



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668



669

On postmortem examination (663), the carcass is pale, anaemic and slightly jaundiced. Unclotted blood can be seen on the hide adjacent to the spine. The liver is enlarged and mottled (664) and the distended gall-

bladder contains thick bile, and there is splenic enlargement. Recovered animals may remain carriers for life. These illustrations are from Zimbabwe and from Queensland, Australia.

663



664

Theileriosis ('East Coast fever', ECF)

Theileria species are tick-borne protozoal parasites that multiply in lymphocytes and then enter erythrocytes. Theileriosis is common in tick-infested areas throughout the world. *T. parva* (East Coast fever, ECF), transmitted by *Rhipicephalus appendiculatus*, is a serious problem in Central and East Africa. *T. annulata*, transmitted by *Hyalomma* species, occurs in North Africa, the Middle East, India and Asia. In 665, the Jersey heifer from Zimbabwe is in poor condition and shows gross enlargement of the parotid and prescapular lymph nodes, a rough coat (particularly dorsally), and matted hair over the face due to epiphora. Affected animals are pyrexemic and anaemic. On postmortem examination, splenic enlargement severe pulmonary emphysema and oedema, and



665

generalised lymphoid hyperplasia are the most striking changes.

Enzootic (adult) bovine leukosis (EBL)

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696



69