

## Appendix 1: Tackle Injury Cases Studies

Study (1996-2000)	Player details	Injury mechanism	Diagnosis	Treatment and long-term outcome
Jones and Journeaux, 1996 <sup>1</sup>	40-year-old male rugby union player	Tackled from front, direct blow to front of tibia causing knee hyperextension (tackled)	Left popliteal artery avulsion, rupture of posterior capsule and cruciate ligaments	Surgery, full above-knee plaster cast, discharged from hospital 7 days after injury, stable at 3 months follow-up
Carr et al., 1999 <sup>2</sup>	28-year-old male rugby player	Received a 'head-butt' to the sternum during a tackle (role unknown)	Considerable mediastinal haemorrhage	Left chest drain inserted to remove pooled blood (removed after 3 days, discharged from hospital after 8 days)
Griffiths and Townend, 1999 <sup>3</sup>	29-year-old male rugby player	Elbowed on right side of face during tackle (tackled)	Medial dislocation of unilateral fractured condyle causing damage to mandibular branch of trigeminal nerve	Two surgeries, reported 1 year postoperatively that sensation had returned to approximately 70% of normal
Kemp and Targett, 1999 <sup>4</sup>	33-year-old professional rugby union player	Blow to posterolateral aspect of left shoulder by opponent's shoulder during tackle (role unknown)	Posterior subluxation of first rib costal cartilage and fracture of posterior aspect of sternum	Conservative management, free of pain after 12 weeks and return to contact sport
Raisanen et al., 1999 <sup>5</sup>	20-year-old male rugby player	Tackled and struck head on ground (tackled)	Diffuse axonal injury (DAI) with LOC	Surgery?, declared brain dead 15 hours after LOC
Duguid and Leaver, 2000 <sup>6</sup>	29-year-old male rugby player (myopic)	Right eye deliberately gouged by opponent's thumb in tackle (role unknown)	Double giant retinal tear	Surgery, visual acuity improved (corrected with glasses) with some minification of image in right eye

Jena et al., 2001 <sup>7</sup>	26-year-old male semi-professional rugby player	Forceful hyperflexion of wrist during heavy head on tackle (unsure of role)	Avulsion fracture of base of second metacarpal	Surgery, full range of motion of wrist 12 weeks later (no pain)
Reid and Trent, 2002 <sup>8</sup>	25-year-old male professional rugby union player	Tackled from the left side by an opposition player (tackled)	Brachial plexus neuropraxia principally involving sixth cervical (C6) nerve root on left side	Conservative management, returned to contact sports after rehabilitation 5 weeks after injury
Giannoudis et al., 2003 <sup>9</sup>	34-year-old male rugby player	Tackled from behind, landed on flexed right knee with leg in adducted position (tackled)	Posterior fracture-dislocation of hip	Relocation of dislocated hip, surgery, resumed light sporting activities 9 months after injury
Vasudevan et al., 2003 <sup>10</sup>	21-year-old male rugby player (insulin-dependent diabetes mellitus)	Injured in a tackle during match (tackled)	Coronary artery dissection causing a myocardial infarction	Thrombolysis, uneventful recovery
Crook and Eynon, 2005 <sup>11</sup>	15-year-old female rugby player	Head forcibly extended and rotated to right during tackle (tackler)	Rotatory subluxation of C1 on C2	Halo skull traction, neck immobilised, discharged from hospital 11 days after injury, full range of motion of neck 3 months later (no pain)
Jones et al., 2005 <sup>12</sup>	15-year-old male rugby player (undisplaced odontoid fracture 2 years previously)	Lifted and came down onto head during tackle (tackled)	Odontoid non-united (type II) fracture	Direct anterior screw fixation and application of hard cervical orthosis, removed after 5 months, regained full range of neck motion following 5 months of physiotherapy
Leigh-Smith et al., 2005 <sup>13</sup>	28-year-old male rugby player (eighth-man)	Ran head first into tackle, causing axial compression to neck (tackled)	Pronounced retropharyngeal swelling and Atlas vertebral fracture	Neck immobilised in Aspen collar cervical orthosis for 8 weeks, permanent removal from contact sport

Mirza et al., 2005 <sup>14</sup>	19-year-old male rugby player	Ball in left arm, tackled from behind, fell to ground carrying weight of tackler (tackled)	Posterior sternoclavicular dislocation on left side	Surgery to relocate dislocation, discharged from hospital after 2 days, polysling to immobilise shoulder for 3-4 weeks, reduction stable at 8 month follow-up
Croft et al., 2006 <sup>15</sup>	31-year-old male rugby player	Rotation to right to pass ball as opposing player tackled and landed on his left leg, forcing abduction (tackled)	Obturator hip dislocation with ipsilateral anterior cruciate ligament injury	Relocation of dislocated hip and conservative treatment of knee, admitted overnight for observation
Horan and Quin, 2006 <sup>16</sup>	22-year-old male rugby player	Tackled from left side while turning to left, fell to ground (tackled)	Proximal tibiofibular joint dislocation of left knee	Relocation of dislocated knee
MacGiobain et al., 2008 <sup>17</sup>	29-year-old male professional rugby union player	Tackled at training with foot planted on ground resulting in twisting of knee as pulled to ground (tackled)	Isolated proximal tibiofibular joint dislocation	Surgery to relocate dislocation, discharged from hospital day after surgery, returned to contact sports after rehabilitation 10 weeks after injury
Shimizu et al., 2008 <sup>18</sup>	17-year-old male rugby player	Tackled from right side and fell to ground on left side (tackled)	Lethal aortic arch injury caused by posterior dislocation of sternoclavicular joint with LOC	Surgery, declared brain dead 23 days after LOC
Thakore et al., 2008 <sup>19</sup>	31-year-old male rugby player	Received a hand-off to jaw during tackle causing neck to extend and rotate to left (role unknown)	Delayed rupture of common carotid artery	Admitted to hospital 2 weeks after injury, intubated, surgery
Caesar et al., 2009 <sup>20</sup>	15-year-old male rugby player	Point of elbow from tackler driven into body of scapula (tackled)	Locked and angulated fracture of right scapula	Manipulation under anaesthetic, reduction stable at 3 weeks follow-up

Hogan et al., 2009 <sup>21</sup>	16-year-old male rugby player	Tackled opponent with shoulder (tackler)	Superior glenoid rim fracture involving superior labrum–biceps anchor complex	Surgery, sling immobilisation for 4 weeks, returned to contact sports 18 months after injury
Jans et al., 2009 <sup>22</sup>	16-year-old male rugby player	Fell on back of head following tackle, head forced into rapid flexion (role unknown)	Anteroposterior cleft of atlas (asymptomatic bipartite atlas mimicking atlantoaxial instability)	Neck immobilised with soft collar for 1 week, discharged from hospital 2 days after injury, permanent removal from contact sport, persistent cervical discomfort after physical activity
Rankin et al., 2009 <sup>23</sup>	24-year-old male rugby union player	Sustained a non-specific blow to abdomen from opponent's shoulder during a head-on tackle (tackled)	Massive colonic haematoma	Surgery, discharged from hospital 7 days after injury, estimated return to contact sports 9 months after injury
Shimoda et al., 2009 <sup>24</sup>	33-year-old male rugby player	Injured in a tackle during match (tackled)	Damage to anterior surface of head of pancreas and intra-abdominal bleeding	Surgery, discharged from hospital 15 days after injury, returned to contact sports 2-and-a-half months after injury
Singhal and Kejriwal, 2009 <sup>25</sup>	33-year-old male rugby player	Blow to chest during tackle (role unknown)	Ascending aortic tear and severe aortic regurgitation	Surgery, discharged from hospital 7 days post-op
Chaudhry et al., 2011 <sup>26</sup>	17-year-old male rugby player	Player was 'dump tackled' and landed on right shoulder (tackled)	Posterior dislocation of right sternoclavicular joint	Surgery to relocate dislocation
Good et al., 2011 <sup>27</sup>	16-year-old male rugby union player	Double tackle from left, fell onto flexed right knee (tackled)	Posterior fracture-dislocation of right hip	Relocation of dislocated hip, surgery, discharged from hospital 3 days post-op, full recovery 6 months later (no

				pain), resumed light sporting activities
Good et al., 2011 <sup>27</sup>	24-year-old male rugby union player	Double tackle from left, fell onto flexed right knee (tackled)	Comminuted posterior wall-posterior column right acetabular fracture	Surgery, discharged from hospital 3 days post-op, full recovery 6 months later (no pain), resumed light gym activities
Westwood and Milsom, 2011 <sup>28</sup>	31-year-old male amateur rugby union player (outside centre with longstanding reducible right inguinal hernia)	Blow to right groin/hernia during tackle (role unknown)	Colonic perforation	Surgery, discharged from hospital 5 days post-op
Alsey et al., 2012 <sup>29</sup>	14-year-old male rugby player	Violent tackle (tackled)	Minimally displaced fracture at base of coracoid	Sling immobilisation for 4 weeks
Kelly et al., 2013 <sup>30</sup>	13-year-old male rugby player	Ring finger entangled in opponents' jersey during tackle, extension at distal inter-phalangeal joint (role unknown)	Rupture of both the flexor digitorum profundus tendon in zones I and III	Surgery, full range of motion following 3 months of hand therapy
Lopez et al., 2013 <sup>31</sup>	27-year-old male amateur American Division II rugby player	Shoulder tackle into left upper anterior thorax (tackled)	Midsubstance costal cartilage fracture of the fifth and sixth ribs	Conservative management, permanent removal from contact sport
Vanzo et al., 2013 <sup>32</sup>	11-year-old male rugby player	Tackled from behind by 3 opposing players and fell onto ground while holding ball resulting in chest compression (tackled)	Pneumomediastinum and pneumopericardium	Conservative management, discharged from hospital after 8 days, returned to contact sports 5 months after injury

Cuellar et al., 2014 <sup>33</sup>	25-year-old male professional rugby union player (scrum-half)	Tackled during one-on-one drill at practice, hit ground and collapsed after standing back up (tackled)	Blunt cerebrovascular injury (BCVI)	Received CPR and intubation at scene, maximal medical therapy overnight, declared brain dead 36 hours after LOC
McLoughlin et al., 2014 <sup>34</sup>	13-year-old male rugby player	Tackled by opposing player, landed on and head pushed into ground (tackled)	Severe sprain of sub-axial cervical spine (C2 and C3 vertebrae)	Surgery, full range of motion of neck at 12 month follow-up (no pain)
Perry et al., 2014 <sup>35</sup>	25-year-old male professional rugby union player	Blow to the abdomen tackle (role unknown)	Complete jejunal transection with associated mesenteric tear	Surgery, discharged from hospital 9 days post-op, return to contact sport 2 months after injury
Rebbeck and Liebert, 2014 <sup>36</sup>	14-year-old male rugby player	Player underwent neck flexion-extension (whiplash associated disorder or WAD) during a tackle (role unknown)	Cranio-vertebral instability (CVI) producing spinal cord sensory irritation due to loss of bony or ligamentous integrity	Conservative management (neck collar for 4 weeks), returned to sport 12 weeks after injury and rehabilitation but told to avoid contact sport
Moore, 2016 <sup>37</sup>	22-year-old male rugby union player	Experienced blunt trauma during a heavy tackle (role unknown)	Transection of pancreas at mid-body, bleeding from splenic artery, large retroperitoneal haematoma	Surgery, discharged from hospital 9 days after injury

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