W. Ribbans *Professor*
Consultant Orthopaedic Surgeon
The County Clinic, Northampton, UK
e-mail: billribbs@uk-doctors.co.uk

Medico-legal issues in the foot and ankle specialty

Like all subspecialty areas within orthopaedic surgery, foot and ankle work carries risks, complications and the potential for litigation. Certain areas of this work have been highlighted for this article to aid the surgeon in appropriately counselling the patient, and improving understanding of major risk areas and knowledge of the outcomes of injury and surgery.

FOOT AND ANKLE LITIGATION CLAIMS

Historically, information on litigation claims has been difficult to acquire because it involves obtaining information from a number of different bodies. There is no mechanism for compulsory reporting of complications, coding accuracy is usually found wanting, and most claims are either dismissed or settled without going to court. However, in 2014, Ring[1] provided an analysis of 1214 National Health Service Litigation Authority (NHSLA) claims in England, involving foot and ankle surgery, over 17 years. These represented 12.6% of orthopaedic claims. Thirty-four per cent of claims involved the ankle, with 73% resulting from trauma. Twenty-one per cent involved the first ray, of which 98% involved elective surgery. Nineteen per cent of claims involved diagnostic errors, 19% were for alleged incompetent surgery, and a further 13% for mismanagement. The authors recognised that reducing incorrect, delayed and missed diagnoses was a key area for improvement.

Medico-legal implications:

- One in 8 orthopaedic claims involve the foot and ankle.
- Only one in 5 claims arise from incompetent surgery allegations.
- The importance of reaching a correct and timely diagnosis with a cogent management plan cannot be overemphasised.

NERVE INJURY

Nerve injury is a common foot and ankle surgical complication, with the most frequent causes being inadvertent laceration, entrapment under metalwork, contusion/soft-tissue swelling and accidental injury from suture needle placement. This may result in diminished sensation, painful neuroma formation, adverse effects on mobility and problems with footwear. The sural, superficial peroneal, deep peroneal, saphenous and tibial nerves can all be injured.

Bai[2] reported a 6% nerve injury rate following ankle surgery, involving sural, superficial peroneal and medial plantar nerve injury. Ferkel[3] reported that 49% of complications following ankle arthroscopy were neurological.

The **sural nerve** is particularly at risk in Achilles tendon surgery, hindfoot posterolateral approaches and incisions of the lateral aspect of the foot. Paavola[4] reported a nerve injury rate of 0.9% in surgery for chronic Achilles tendinopathy. Kirkley[5] recorded a 6.0% rate in surgical repair of Achilles ruptures, although Lim[6] described a 10.5% incidence of sural nerve region paraesthesia prior to Achilles rupture surgery. Similar to axillary nerve injury in shoulder dislocations, it would be helpful to document nerve health prior to intervention. Ribbans' review[7] reported an 11% injury rate in the open posterolateral approach for posterior ankle impingement syndrome. Injury during open reduction of calcaneal fractures has been reported in numerous publications, with rates as high as 55% described.[8]

The **superficial peroneal nerve** is at risk in fixation of fibular fractures, ankle ligament reconstruction and ankle arthroscopy. Redfern[9] reported a 15% incidence of superficial peroneal nerve injury following open reduction and internal fixation (ORIF) of ankle fractures. This could be reduced by making a more posterolateral incision. Deng[10] reported a 3.5% incidence, and Ferkel[3] a 2.4% incidence, of nerve injury following ankle arthroscopy.

Medico-legal implications:

- Nerve injuries are a common potential complication of foot and ankle surgery and procedures should be planned with nerve anatomy in mind.
- Patients should be counselled preoperatively about nerve injury and specific nerve risks according to the planned procedure.

COMPLEX REGIONAL PAIN SYNDROME

Complex regional pain syndrome (CRPS) is a relatively rare but well-recognised complication following trauma and elective surgery to the foot and ankle.

Foot and ankle trauma is the most likely outcome with contusions, sprains, crush injuries, and fractures, including prolonged immobilisation. One small series [11] found that trauma was the most common cause (73%), of which fractures accounted for 45%. The other 27% were secondary to elective foot surgery, with neuroma excision the most common procedure. A low threshold of suspicion is required and a rapid referral to a multidisciplinary unit most likely to yield optimal outcomes.[12,13] The combined incidence of CRPS following open

reduction for calcaneal fractures using a variety of approaches was 7% in 139 cases.[14-16]

A Scottish retrospective study[17] found an incidence of 4.4% in 390 patients undergoing elective foot and ankle surgery. The condition appeared to have a particular predilection for middle-aged females and those with a pre-existing history of anxiety and depression. The authors felt that such patients should be counselled pre-operatively regarding such a potential complication.

Medico-legal implications:

- With an overall risk of 1 in 23 patients, CRPS should reasonably be added to any developed patient information leaflets and consenting process.

THROMBOEMBOLIC ISSUES

While the use of anti-thrombotic prophylaxis in major hip and knee surgery is well-established, its use in foot and ankle surgery remains a contentious issue.

Griffiths[18] reported upon 2627 elective foot and ankle procedures over a seven-year period, of whom 41% had aspirin and 59% no prophylaxis. There was no apparent protective effect of aspirin and the overall incidence of DVTs was 0.27%, and pulmonary emboli of 0.15% at three months. The authors concluded that the risk of clinically significant thromboembolic events in elective foot and ankle surgery was low, and chemoprophylaxis should be confined to high-risk groups for VTE. Hamilton[19] reported upon a postal questionnaire to UK foot and ankle surgeons who between them undertook 33 500 elective cases per annum. The reported perceived incidence of DVTs was 0.6%, PEs 0.1%, and fatal PEs of 0.02%. Solis[20] reported an ultrasound incidence of DVTs of 3.5% in 201 elective patients with no clinical symptoms of a thromboembolic event.

The incidence of thromboembolic events following trauma may be greater than elective surgery. Most work has centred on tendo Achillis ruptures. Patel[21] retrospectively reported an incidence of 0.43% for DVTs and 0.32% for PEs. Nilsson-Helander[22] reported colour duplex sonography findings of DVTs in 34% and PEs in 3% of 95 acute ruptures, with no difference between non-surgical and surgical patients.

Medico-legal implications:

- BOFAS guidelines[23] published in 2010 considered most elective foot and ankle procedures as low-risk for a thromboembolic event.
- The decision to place patients on chemical thromboprophylaxis should be based upon patient-specific factors.

INFECTION IN FOOT AND ANKLE SURGERY

Infection is an ever-present risk in surgery. A major prospective survey of 1737 patients undergoing elective foot and ankle surgery described an overall 14.5% wound healing and/or infection rate – 11.6% had minor wound problems; 2.4% required antibiotics to control a post-operative infection; and 0.5% required re-admission for intravenous antibiotics and/or surgery.[24] A retrospective review of 1000 patients[25] undergoing foot and ankle surgery reported an overall infection rate of 4.8% but diabetic patients had a rate of 13.2% compared with non-diabetics, whose incidence was 2.8%. Further analysis demonstrated that patients with complicated diabetes, such as neuropathy, had a tenfold increased infection risk compared with non-diabetics.

Medico-legal implications:

- Up to one in seven elective foot and ankle procedures can result in wound healing problems and/or infection.
- Diabetic patients, especially those with neuropathy, have a significantly increased risk of post-operative infection.

INJECTING AROUND THE FOOT AND ANKLE

Various soft-tissue and articular injections for both diagnostic and therapeutic purposes are widely used in foot and ankle practice. However, the administration of such injections is not without hazard. Local complications can include skin atrophy, hypopigmentation, increased pain, steroid flare, and infection. Systemic effects can occur including skin rash, flushing and menstrual irregularities. Rarer complications including osteomyelitis have been described. A review of extra-articular steroid injections in general reported a risk of major adverse effects ranging from between 0% and 5.8%, and of minor events ranging between 0% and 81%.[26] Hunter[27] reported an approximate rate of septic arthritis following an intra-articular injection of steroids as 1:10 000.

Within the foot and ankle, the following should be particularly acknowledged:

- Atrophy of the plantar fat pad from injections for plantar fasciitis and Morton's neuroma.
- Rupture of the plantar plate following injections to the lesser MTP joints or inter-metatarsal space.
- Rupture of the plantar fascia following injections for plantar fasciitis – reported to be as high as 10%.[28]
- Counsel patients carefully pre-injection and acquaint them with potential complications.

TOTAL ANKLE ARTHROPLASTY SURGERY

The UK National Joint Registry has only been acquiring data about total ankle arthroplasties (TAAs) since 2010. As a result, the long-term survivorship of TAAs nationally is not as well-progressed as it is for hips and knees, particularly when the relatively low number of procedures performed is taken into account.

In 2014, 509 primary TAAs were recorded in the UK[29] compared with 83 125 knee, 95 850 hip, and 4756 shoulder replacements.

Survivorship of specific TAAs has been reported. For example, Barg[30] reported 94% and 84% survivorship for the Hintegra TAA at five and ten years, respectively. For the STAR TAR, five-year survivorship has been reported at 89% to 90%[31,32] and 71% to 76% at ten years.[31,33] The Swedish Registry recommended patients be advised that, using modern designs of TAAs, the probability of implant survival is around 80%.[34] With the limited data available, the NJR estimates that the four-year cumulative revision risk for a TAA (2010-2014) was 3.28%.

Haddad[35] undertook a systematic review of the literature, establishing and comparing the intermediate and long-term outcomes of TAA and ankle fusion (Table I). The analysis revealed similar results in both procedures for end-stage ankle arthritis:

Medico-legal implications:

- Compared with hip and knee arthroplasty surgery, TAA is still undertaken in relatively small numbers.
- A reasonable estimate of TAA implant survival at ten years is about 80%.
- In experienced hands, TAA outcomes can rival those of ankle fusion.

Table I. Haddad et al. (2007):[35] outcomes of TAA and ankle fusion

	TAA	Ankle fusion
Patients	852	1262
Results:		
Excellent	38.0%	31%
Good	30.5%	37%
Fair	5.5%	13%
Poor	24.0%	13%
Survivorship (TAA only):		
5 years	78%	
10 years	77%	
Revision surgery	7%	9%

MISDIAGNOSIS OF ACUTE TENDO ACHILLIS RUPTURE

Acute ruptures of the tendo Achillis can present to a variety of healthcare professionals. Frequently the patient does not appreciate the significance of the injury. The diagnosis is missed in up to 25% of patients on initial assessment[36-39] but rises higher in the elderly, with a 36% misdiagnosis in the over-65-year-old group. This is felt to be due to both reduced patient awareness and lowered clinical suspicion.[40]

Medico-legal implications:

- A careful clinical assessment and, if necessary, a confirmatory ultrasound or MRI is important in patients of all ages presenting with suspicious Achilles injuries.

LATERAL ANKLE LIGAMENT SPRAINS

A considerable amount of literature is available on the epidemiology of lateral ankle ligament sprains.[41,42] In the UK, it is estimated that approximately 1.8 million ankle sprains occur annually but only 300 000 present in emergency departments. Fourteen per cent of injuries are regarded as severe, and the risk of re-injury within three years is regarded as 34% in the general population and 73% in athletes. There are variable estimates of patients making a full recovery within three years ranging between 36% and 85%.

Medico-legal implications:

- Ankle sprains are among the most common conditions presenting to emergency departments.
- However, they are not always benign injuries, with a sizeable proportion experiencing re-injury and prolonged and incomplete recoveries.

COMMONLY MISSED FOOT AND ANKLE FRACTURES

From the many fractures witnessed within the foot and ankle, several have a particular reputation for being commonly missed on initial presentation, including:

Calcaneal body fractures. This injury, which has a reputation for poor outcomes, is missed in up to 10% of cases.[43]

Anterior process of the calcaneum fractures. This fracture represents 15% of all calcaneal fractures but is commonly misdiagnosed as an ankle sprain.[44] Up to 25% of these fractures can remain symptomatic for up to 12 months after injury despite apparent radiographic union.[45] Nonunions may require excision.

Lateral process of the talus (LPT) fractures. With the increasing popularity of snowboarding, the incidence of LPT fractures has increased in recent years. These injuries are now commonly referred to as 'snowboarder's fracture' and are believed to be caused by an external rotation or eversion stress placed on an axial loaded dorsiflexed ankle,[46] with between 33% and 41% being missed on initial presentation.[44]

Lisfranc injuries. Injuries to the Lisfranc midfoot complex can range from severe displaced fracture-dislocations to subtle ligamentous injuries. However, long-term deformity and disability is common, particularly if the diagnosis is delayed which occurs in 20% to 40% of cases.[47]

Medico-legal implications:

- Overall, 7.6% of foot fractures and 2.8% of ankle fractures were missed in the emergency department,[48] with several specific fractures commonly misdiagnosed.

REFERENCES

1. Ring J, Talbot CL, Clough TM. Clinical negligence in foot and ankle surgery. A 17-year review of claims to the NHS Litigation Authority. *Bone Joint J* 2014;96-B:1510-1514.

2. Bai L, Han Y-N, Zhang W-T, Huang W, Zhang H-L. Natural history of sensory nerve recovery after cutaneous nerve injury following foot and ankle surgery. *Neural Regen Res* 2015;10: 99–103.

3. Ferkel RD, Heath DD, Guhl JF. Neurological complications of ankle arthroscopy. *Arthroscopy* 1996;12:200-208.

4. Paavola M, Orava S, Leppilahti J, Kannus P, Jarvinen M. Chronic Achilles tendon overuse injury: complications after surgical treatment. An analysis of 432 consecutive patients. *Am J Sports Med* 2000;28:77-82.

5. Kirkley A, Lo IKY, Norweiler B, Kumbhane DA. Operative versus nonoperative treatment of acute Achilles tendon ruptures: a quantitative review. *Clin J Sport Med* 1997;7:207-211.

6. Lim J, Dalai R, Waseem M. Percutaneous vs open repair of the ruptured Achilles tendon – a prospective randomized controlled study. *Foot Ankle Int* 2001:22;559-568.

7. Ribbans WJ, Ribbans HA, Cruickshank JA, Wood EV. The management of posterior ankle impingement syndrome in sport: a review. *Foot Ankle Surg* 2015;21:1-10.

8. Eastwood D, Atkins RM. Lateral approaches to the heel: a comparison of two incisions for the fixation of calcaneal fractures. *Foot* 1992;2:143-147.

9. Redfern DJ, Sauve PS, Sakellariou A. Investigation of incidence of superficial peroneal nerve injury following ankle fracture. *Foot Ankle Int* 2003;24:771–774.

10. Deng DF, Hamilton GA, Lee M, et al. Complications associated with foot and ankle arthroscopy. *J Foot Ankle Surg* 2012;51:281-284.

11. Anderson DJ, Fallat LM. Complex regional pain syndrome of the lower extremity: a retrospective study of 33 patients. *J Foot Ankle Surg* 1999;38:381-387.

12. Nambi-Joseph P, Stanton-Hicks M, Sferra JJ. Interventional modalities in the treatment of complex regional pain syndrome. *Foot Ankle Clin N Am* 2004;9:405-417.

13. Shah A, Kirchner JS. Complex regional pain syndrome. *Foot Ankle Clin N Am* 2011;16:351-356.

14. Chan S, Ip FK. Open reduction and internal fixation for displaced intra-articular fractures of the os calcis. *Injury* 1995;26:111-115.

15. Wiley WB, Norberg JD, Klonk CJ, Alexander IJ. "Smile" incision: an approach for open reduction and internal fixation of calcaneal fractures. *Foot Ankle Int* 2005;26:590-592.

16. Weber M, Lehmann O, Sägesser D, Krause F. Limited open reduction and internal fixation of displaced intra-articular fractures of the calcaneum. *J Bone Joint Surg [Br]* 2008;90-B:1608-1616.

17. Rewhorn MJ, Leung AH, Gillespie A, Moir JS, Miller R. Incidence of complex regional pain syndrome after foot and ankle surgery. *J Foot Ankle Surg* 2014;53:256-258.

18. Griffiths JT, Matthews L, Pearce CJ, Calder JT. Incidence of venous thromboembolism in elective foot and ankle surgery with and without aspirin prophylaxis. *J Bone Joint Surg [Br]* 2012;94-B:210-214.

19. Hamilton PD, Hariharan K, Robinson AHN. Thromboprophylaxis in elective foot and ankle patients – current practice in the United Kingdom. *Foot Ankle Surg* 2011;17:89-93.

20. Solis G, Saxby T. Incidence of DVT following surgery of the foot and ankle. *Foot Ankle Int* 2002;23:411-414.

21. Patel A, Ogawa B, Charlton T, Thordarson D. Incidence of deep vein thrombosis and pulmonary embolism after Achilles tendon rupture. *Clin Orthop Relat Res* 2012;470:270-274.

22. Nilsson-Helander K, Thurin A, Karlsson J, Eriksson BI. High incidence of deep venous thrombosis after Achilles tendon rupture: a prospective study. *Knee Surg Sports Traumatol Arthrosc* 2009;17:1234-1238.

23. No authors listed. Current British Orthopaedic Foot and Ankle Society position statement on VTE prophylaxis in foot and ankle surgery, 20 April 2010. www.bofas.org.uk (date last accessed 16 December 2015).

24. Williams MT, Molloy AP, Simmonds DJ, Butcher CK. Infection rates in foot and ankle surgery. *J Bone Joint Surg [Br]* 2012;94-B(Suppl XXII):28.

25. Wukich DK, Lowery NJ, McMillen RL, Frykberg RG. Postoperative infection rates in foot and ankle surgery: a comparison

of patients with and without diabetes mellitus. *J Bone Joint Surg [Am]* 2010;92-A:287-295.

26. Brinks A, Koes BW, Volkers AC, Verhaar JA, Bierma-Zeinstra SM. Adverse effects of extra-articular corticosteroid injections: a systematic review. *BMC Musculoskelet Disord* 2010;11:206.

27. Hunter JA, Blyth TH. A risk-benefit analysis of intra-articular corticosteroids in rheumatic disorders. *Drug Saf* 1999; 21:353-365.

28. Acevedo JI, Beskin JL. Complications of plantar fascia rupture associated with corticosteroid injection. *Foot Ankle Int* 1998;19:91-97.

29. No authors listed. National Joint Registry 12th annual report 2015. http://www.njrcentre.org.uk/njrcentre/Portals/o/Documents/England/Reports/12th%20annual%20report/NJR%20Online%20Annual%20Report%202015.pdf (date last accessed 16 December 2015).

30. Barg A, Zwicky L, Knupp M, Henninger HB, Hintermann B. HINTEGRA total ankle replacement: survivorship analysis in 684 patients. *J Bone Joint Surg [Am]* 2013;95-A:1175-1183.

31. Fevang BT, Lie Sa, Havelin LI, et al. 257 ankle arthroplasties performed in Norway between 1994 and 2005. *Acta Orthop* 2007;78:575-583.

32. Karantana A, Hobson S, Dhar S. The Scandinavian total ankle replacement: survivorship at 5 and 8 years comparable to other series. *Clin Orthop Relat Res* 2010;468:951–957.

33. Brunner S, Barg A, Knupp M, et al. The Scandinavian total ankle replacement: long-term, eleven to fifteen-year, survivorship analysis of the prosthesis in seventy-two consecutive patients. *J Bone Joint Surg [Am]* 2013; 95-A:711-718.

34. Henricson A, Nilsson J-A, Carlsson A. 10-year survival of total ankle arthroplasties. A report on 780 cases from the Swedish Ankle Register. *Acta Orthop* 2011; 82:655–659.

35. Haddad SL, Coetzee JC, Estok R, et al. Intermediate and long-term outcomes of total ankle arthroplasty and ankle arthrodesis. A systematic review of the literature. *J Bone Joint Surg [Am]* 2007;89-A:1899-1905.

36. Arner O, Lindholm A. Subcutaneous rupture of the Achilles tendon; a study of 92 cases. *Acta Chir Scand Suppl* 1959;116(Suppl 239):1-51.

37. Nillius S, Nilsson B, Westlin N. The incidence of Achilles tendon rupture. *Acta Orthop Scand* 1976;47:118-121.

38. Inglis AE, Scott WN, Sculco TP, et al. Ruptures of the tendo Achilles. An objective assessment of surgical and non-surgical treatment. *J Bone Joint Surg [Am]* 1976;58-A:990-993.

39. Ballas MT, Tytko J, Mannarino F. Commonly missed orthopedic problems. *Am Fam Phys* 1998;57:267-274.

40. Nestorson J, Movin T, Möller M, Karlsson J. Function after Achilles tendon rupture in the elderly: 25 patients older than 65 years followed for 3 years. *Acta Orthop Scand* 2000;71:64-68.

41. Bridgman SA, Clement D, Downing A, et al. Population based epidemiology of ankle sprains attending accident and emergency units in the West Midlands of England, and a survey of UK practice for severe ankle sprains. *Emerg Med J* 2003;20:508-510.

42. van Rijn RM, van Os AG, Bernsen RMD, et al. What is the clinical course of acute ankle sprains? A systematic literature review. *Am J Med* 2008;121:324-331.

43. Freed HA, Shields NN. Most frequently overlooked radiographically apparent fractures in a teaching hospital emergency department. *Ann Emerg Med* 1984;13:900-904.

44. Judd DB, Kim DH. Foot fractures frequently misdiagnosed as ankle sprains. *Am Fam Physician* 2002;66:785-794.

45. Degan TJ, Morrey BF, Braun DP. Surgical excision for anterior-process fractures of the calcaneus. *J Bone Joint Surg [Am]* 1982;64-A:519-524.

46. Valderrabano V, Perren T, Ryf C, Rillmann P, Hintermann B. Snowboarder's talus fracture. Treatment outcome of 20 cases after 3.5 years. *Am J Sports Med* 2005;33:871-880.

47. Goossens M, De Stoop N. Lisfranc's fracture-dislocations: etiology, radiology and results of treatment. A review of 20 cases. *Clin Orthop Relat Res* 1983;176:154-162.

48. Wei CJ, Tsai WC, Tiu CM, et al. Systematic analysis of missed extremity fractures in emergency radiology. *Acta Radiol* 2006;47:710-717.

 DOI: 10.1302/2048-0105.45.360404