Postoperative support for equine joints

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SARAH E TAYLOR discusses current therapeutic options to achieve optimal recovery and minimise complications following various types of equine joint surgery

THERE are many indications for joint surgery in the horse, including treatment of septic arthritis, arthroscopic assessment of cartilage and intraarticular ligamentous injury, arthrodesis and management of articular fractures or subchondral bone cysts that communicate with the articular surface.

Postoperative rehabilitation of joint injuries varies according to the joint involved, the severity of the articular cartilage damage and the type of surgical procedure.

For example, horses with superficial fibrillation of cartilage and recent osteochondral chip fractures may return to training within six weeks of arthroscopic removal. In contrast, horses with carpal slab fractures, full-thickness cartilage loss and subchondral bone involvement may require four to six months' rest (McIlwraith et al, 2005).

There is little evidence-based medicine to guide the equine veterinary surgeon on best practice following joint surgery. This article focuses on current treatment options following joint surgery in the horse, including evaluation of clinical studies, surgical texts and review articles.

Joint pathobiology

The goal of joint surgery is to restore normal physiological function and prevent ongoing damage to the joint, allowing rapid return to athletic function (Frisbie, 2006) and avoiding the development of

osteoarthritis. Osteoarthritis results from the breakdown of key matrix components in the hyaline articular cartilage (aggrecan and, subsequently, type two collagen).

Joint disease and surgery are associated with a myriad of proinflammatory cytokines (TNF-á, IL-1â) and enzymes (MMP-1, MMP-3, MMP-13, ADAMTS-4 and ADAMTS-5) that are deleterious to articular cartilage.

Problems associated with joint surgery

Postoperative complications of joint surgery include infection, pain, distension/synovitis, failure to remove fragments, and failure to return to athletic function.

Anaesthetic-related problems can also arise associated with patient positioning, specifically following long arthroscopic procedures on the femoropatellar joints when the horse is in dorsal recumbency with both hindlimbs fixed in extension.

Iatrogenic septic arthritis has been reported to be as high as 1.5 per cent following elective arthroscopy; surgery of the tarsocrural joint in draught horses was thought to be an increased risk in this study (Olds et al, 2006).

Optimal peri-operative care can help to avoid many of these problems. Good technique and adherence to Halstead’s surgical principles minimises inflammation and trauma resulting from surgical intervention. Antibiotic prophylaxis is discussed in the section on antibiotics.

Pre-operative and intra-operative analgesia

Some equine surgeons advocate the use of joint distension with local anaesthetic prior to arthroscopic procedures.

Studies in the human literature support the pre-operative use of bupivicaine for knee arthroscopy (Hube et al, 2008).

There is controversy surrounding the use of intra-articular morphine in the human field, with older studies suggesting intra-articular morphine reduces postoperative pain scores (Kalso et al, 2002). However, more recent studies report that intraarticular morphine does not improve postoperative pain scores (Rosseland, 2005). Preoperative epidural morphine and detomidine (Figure 1) have been shown to be of benefit in horses undergoing painful stifle arthroscopies (Goodrich et al, 2002).

Antibiotic choice, duration and route

The use of antibiotics for elective joint surgery is largely based on the surgeon’s preference.

Elective diagnostic arthroscopy is usually a short procedure that has very low reported rates of infection; therefore, antibiotic prophylaxis is believed to be unnecessary. In contrast, horses undergoing other types of articular surgery do require antibiotic prophylaxis because of the potentially devastating effects of septic arthritis.

Enterobacteriaceae, staphylococci, streptococci and *Pseudomonas* species are the most common bacterial organisms isolated from orthopaedic infections (Snyder et al, 1987). Therefore, prophylactic antibiotics should have good efficacy against these common equine bacterial pathogens.

Staphylococcus aureus was the most frequently isolated organism in cases of iatrogenic postoperative synovial sepsis in one study (Schneider et al, 1992). Cephalosporins (cetiofur and cefquinome) provide broadspectrum activity with good efficacy against staphylococci and are, therefore, appropriate for prophylactic use for articular procedures. A dose of 2.2mg/kg administered IV or IM twice q12hr for 24 hours is used commonly (Haggett and Wilson, 2008).

Therapeutic use of antibiotics is required when surgery to remove osteochondral fragments is prolonged or if intra-articular implants are being placed, such as lag screw repairs of slab fractures of the third carpal bone (Figure 2) or dynamic compression plating of articular olecranon fractures. Broad-spectrum antibiotic treatment with a combination of IV sodium benzylpenicillin (22,000IU/kg q8hr) and gentamicin (6.6mg/kg q24hr) is often used for three to five days as they have a synergistic effect.

Systemic antibiotic treatment is always indicated for the treatment of septic arthritis. The duration of antibiotic therapy should be based on response to therapy – improving lameness, and reducing synovial effusion and peri-articular swelling. Wright et al (2003) reported a mean duration of 13 days of antibiotic administration in 121 cases of synovial contamination. It should also be noted that these authors used >30,000IU/kg sodium benzylpenicillin q8hr in combination with 2.2mg/kg gentamicin IV q8hr, despite other reports in the literature recommending the use of gentamicin at a dose of 6.6mg/kg q24hr (Godber et al, 1995).

Many horses with septic joints receive three to five days of intravenous antibiotics, with or without seven to 10 days of oral antibiosis. Chronic or refractory joint infections require further investigation through culture of joint fluid and/or synovial membrane and sensitivity testing of any pathogens isolated. Antibiotics such as amikacin (21-25mg/ kg IV q24hr) and enrofloxacin (5mg/kg IV or 7.5mg/kg PO q24 hr) should be reserved for use in these situations, particularly as enrofloxacin has been associated with an increased incidence of MRSA infections in human medicine (Weber et al, 2003).

Many publications document the efficacy of various forms of regional antibiotic administration to treat joint infection (Mills et al, 2000; Pille et al, 2005; Taintor et al, 2006; Werner et al, 2003).

Werner et al (2003) suggest intra-articular administration of gentamicin may be more effective for the treatment of septic arthritis than regional intravenous perfusion, as significantly higher concentrations of antibiotic were achieved following intra-articular administration.

Taintor et al (2006) demonstrated that intra-articular concentrations of amikacin were maintained above the minimal inhibitory concentration for 48 hours, even in inflamed joints. This suggests that intra-articular injections should be repeated every other day.

Bandaging

Bandages are applied to joints to protect them from contamination postoperatively and also to reduce swelling.

The type of bandage applied to support weakened areas following joint surgery depends on the procedure performed.

Two rolls of Soffban beneath a Pressage bandage (Figure 3) may suffice following arthrodesis of the tarsometatarsal and centrodistal joints. However, a distal limb cast (Figure 4) is desirable to provide enhanced support following arthrodesis of the proximal interphalangeal joint (Knox and Watkins, 2006). Layered bandages provide moderate support with increased absorptive capacity if exudation from the surgical site is anticipated, such as for open synovial cavities.

NSAIDs

Reduction of postoperative pain and inflammation is achieved through the systemic administration of NSAIDs and the limitation of exercise in the immediate postoperative period.

Equine surgical texts recommend administration of NSAIDs for three to five days postarthroscopy to reduce inflammation and effusion (McIlwraith, 2005). NSAIDs inhibit the enzyme cyclo-oxygenase (COX), thereby reducing the synthesis of prostaglandins (namely PGE2) and thromboxanes.

NSAIDs have other antiinflammatory effects through the inhibition of cellular inflammation (Dawson et al, 1987).

Carprofen has been shown to reduce oedema and effusion in experimental osteoarthritis in horses by a non-COX mediated pathway (Lees et al, 1994).

Several NSAIDs are available for use in the horse. Phenylbutazone remains the cheapest and most commonly used (Caron, 2003). Some difficulty arises when detection of recurrence of synovial sepsis relies on the development of lameness and/or pyrexia, as NSAIDs are both analgesic and anti-pyretic and, therefore, have the potential to mask these signs. A new dual cyclo-

oxygenase/5-lipoxygenase (COX/5-LOX) inhibitor, licofelone, is now in phase-three clinical trials in human medicine and has already been shown to reduce experimentally induced canine osteoarthritis (Pelletier and Martel-Pelletier, 2007).

Exercise

Horses are usually maintained on box rest for varying periods following joint surgery – again, this is dependent on the type of procedure performed and the extent of damage to the articular cartilage. Motion is known to be vital to cartilage nutrition and, therefore, early return to controlled exercise is desirable.

When osteochondral fragments are removed, time must be allowed for clot formation and initial healing of the defect before exercise is resumed. A period of seven days' box rest is recommended followed by six weeks' hand walking for small fragments with minimal cartilage damage.

As the severity of cartilage damage increases, convalescent times should be increased accordingly; horses with fullthickness cartilage defects and subchondral bone exposure should have four to six months rest (McIlwraith et al, 2005).

Contrastingly, hand walking may be commenced immediately following arthroscopic lavage for the treatment of acute sepsis to promote normal joint metabolism in the absence of cartilage damage. If arthrodesis is performed, exercise is usually limited to box rest for six weeks, followed by in-hand walking for at least two months.

Healing of subchondral bone cysts is usually slow, following arthroscopic-assisted injection with methyl prednisolone acetate. Two weeks' strict box rest followed by three months' box rest with gradually increasing hand walking was used postoperatively in one study (Wallis et al, 2008). In another study, some horses with subchondral bone cysts did not return to their previous level of athletic function despite three years' rest (Smith et al, 2005).

Disease-modifying osteoarthritis drugs

Disease-modifying osteoarthritis drugs (DMOADs) are so named for the chondroprotective effects they exert on articular cartilage. Hyaluronan (HA), polysulphated glycoaminoglycans (PSGAGs), glucosamine and chondrotin sulphate are all DMOADs.

Postoperative use of HA and PSGAGs varies considerably between individual clinicians. Some do not consider intraarticular HA to be a beneficial part of postoperative rehabilitation (McIlwraith et al, 2005). One experimental model found no effect of HA on the composition of cartilage 11 weeks after induction of an osteochondral defect (Barr et al, 1994).

Oral HA gel has been shown to reduce tarsocrural effusion following surgical arthroscopy to remove osteochondral fragments (Bergin et al, 2006). Thoroughbred yearlings with mild or no synovial effusion before surgery were included in this study; those receiving oral HA had significantly reduced postoperative effusion compared to the horses that received placebo treatment.

PSGAGs have been recommended if subchondral bone exposure was evident during arthroscopy (McIlwraith et al, 2005). PSGAGs were shown to reduce clinical signs in an experimental model of carpal osteoarthritis (Todhunter et al, 1993). While PSGAGs are believed to have a chondroprotective effect, some studies in the horse demonstrate no improvement over controls in a physical articular cartilage-defect model (Barr et al, 1994; Yovich et al, 1987).

The oral nutraceuticals glucosamine and chondroitin sulphate have been shown to prevent cartilage degradation in vitro. However, the current labelled dosing recommendations may be too low to achieve this beneficial effect (Dechant, 2008).

Regenerative therapies

Advances in understanding the mechanism of cartilage injury have allowed the development of new treatments that target different pathological pathways.

Autologous conditioned serum (ACS) – marketed as Irap (Genitrix) – is produced by overnight incubation of 50ml of blood with coated glass spheres, followed by collection of the serum for subsequent intra-articular injection. ACS has been shown to be beneficial for knee osteoarthritis in humans (Baltzer et al, 2008) and also to improve histological scores in experimentally induced osteoarthritis in horses (Frisbie et al, 2007). Extrapolation from the human data suggests incubation with the glass spheres results in up-regulation of IL-1Ra (IL-1 receptor antagonist), IL-4, IL- 10, fibroblast growth factor and transforming growth factor-b. The mechanism of action remains unknown, but it is unlikely that ACS will be effective in treating severe cartilage defects.

According to Nixon et al (2005), gene therapy to allow long-term provision of insulinlike growth factor or the anticatabolic factor interleukin-1 receptor antagonist has shown promising results in vitro.

Autologous chondrocyte transplantations are restricted by the limited availability of donor cells (Noth et al, 2008) and difficulties of scaffold incorporation. Mesenchymal stromal cells (Figure 5) have been shown to improve early healing, but did not significantly enhance longterm healing in an experimental equine model (Wilke et al, 2007).

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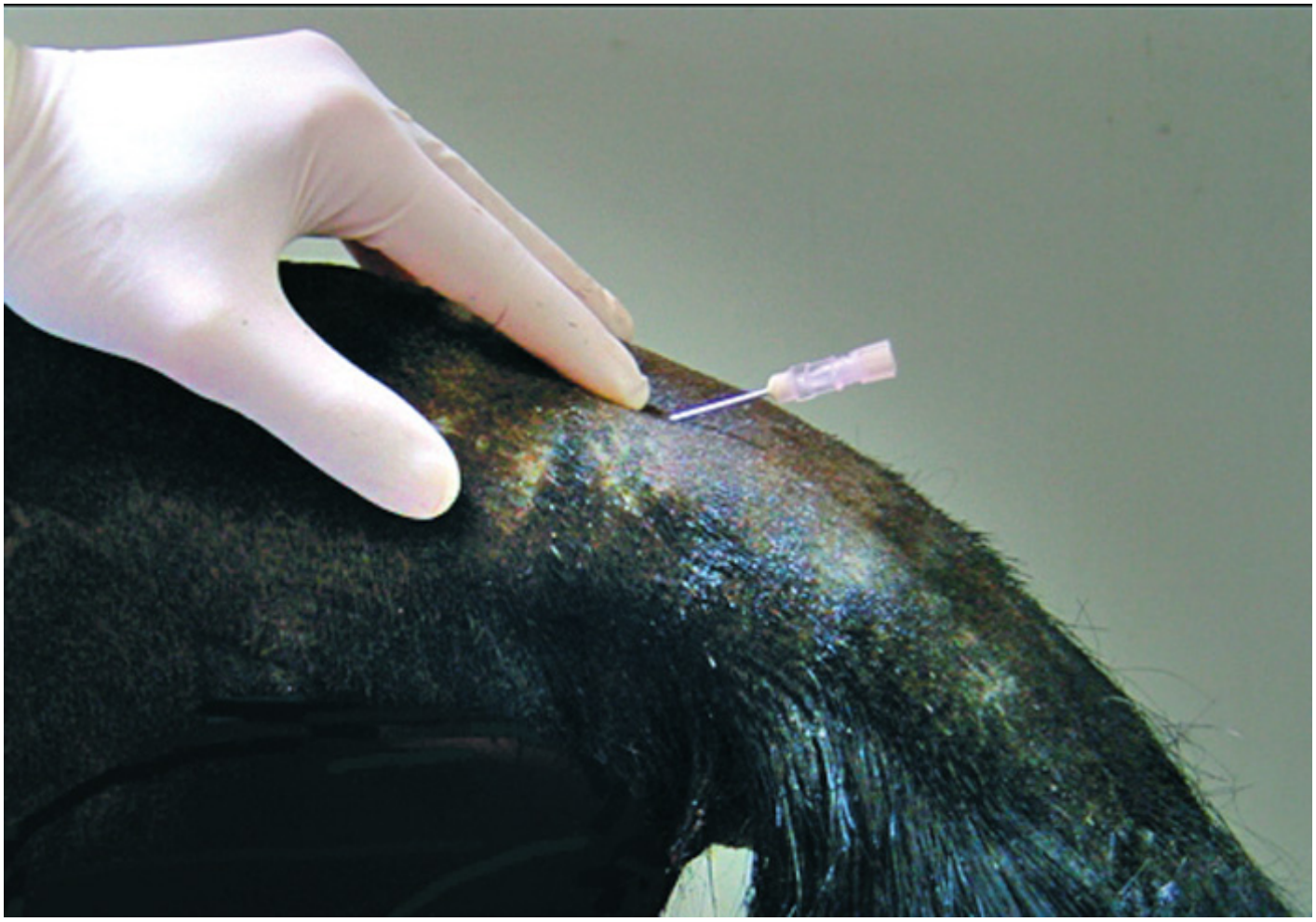

Figure 1. Administration of epidural detomidine and morphine has been shown to be of benefit in horses undergoing painful stifle arthroscopies.

Photo: MARTINA MOSING.

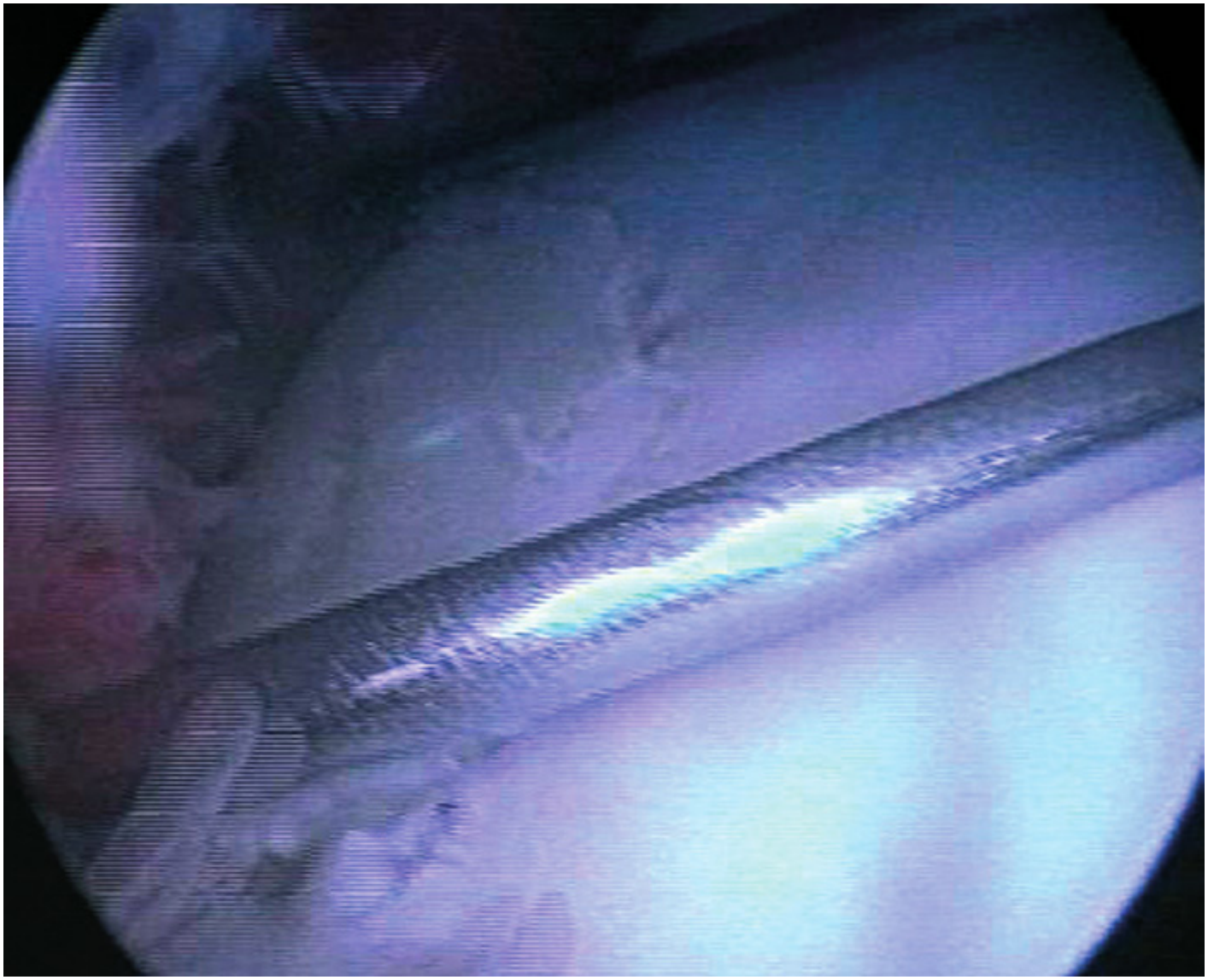

Figure 2. Radiograph of a horse with a slab fracture of the third carpal bone. Arthroscopically subchondral bone exposure was evident, resulting in prolonged convalescence.

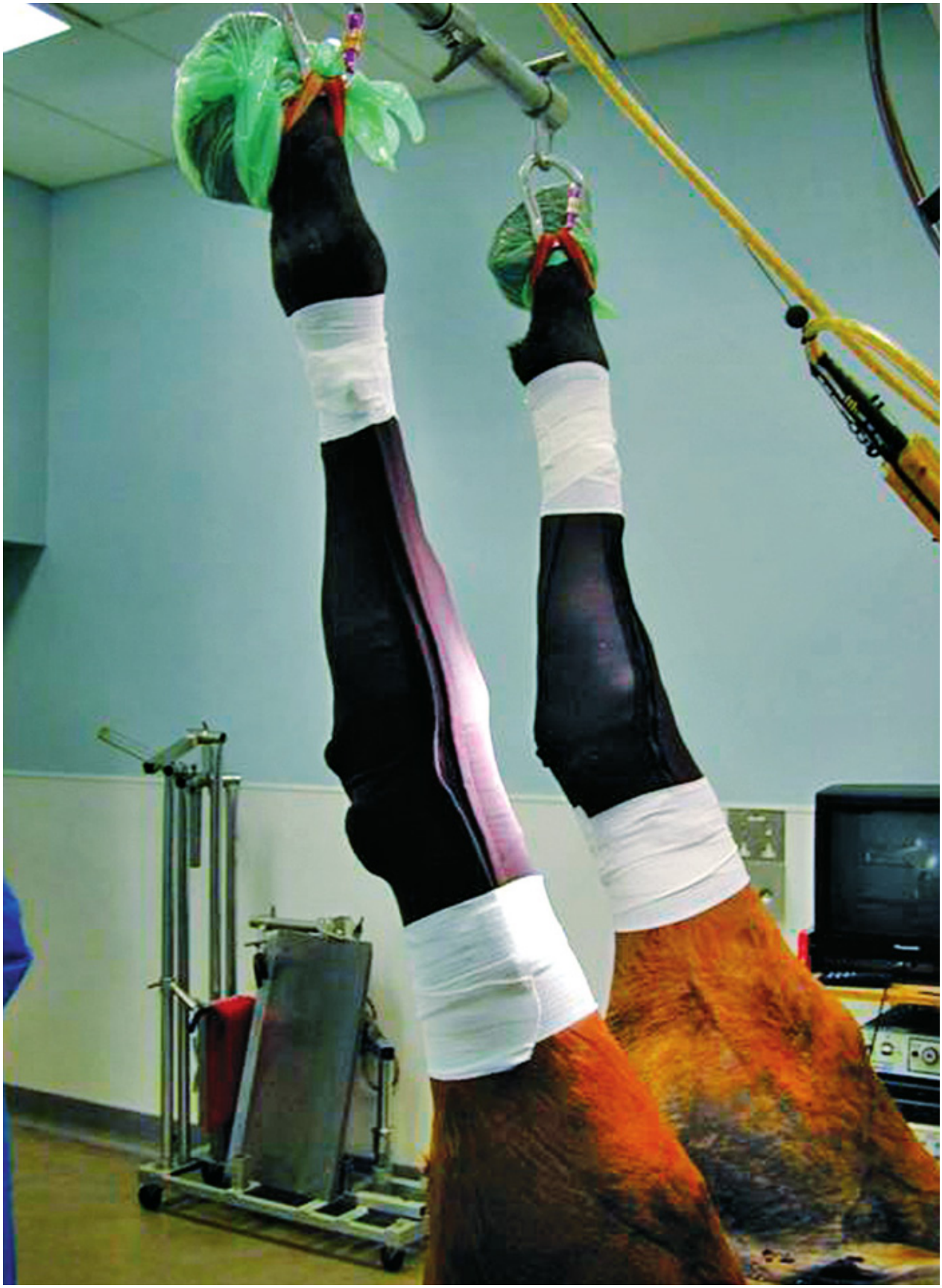

Figure 3. Postoperative application of Pressage bandages to the tarsus following arthrodesis of the tarsometatarsal and centrodistal joints.

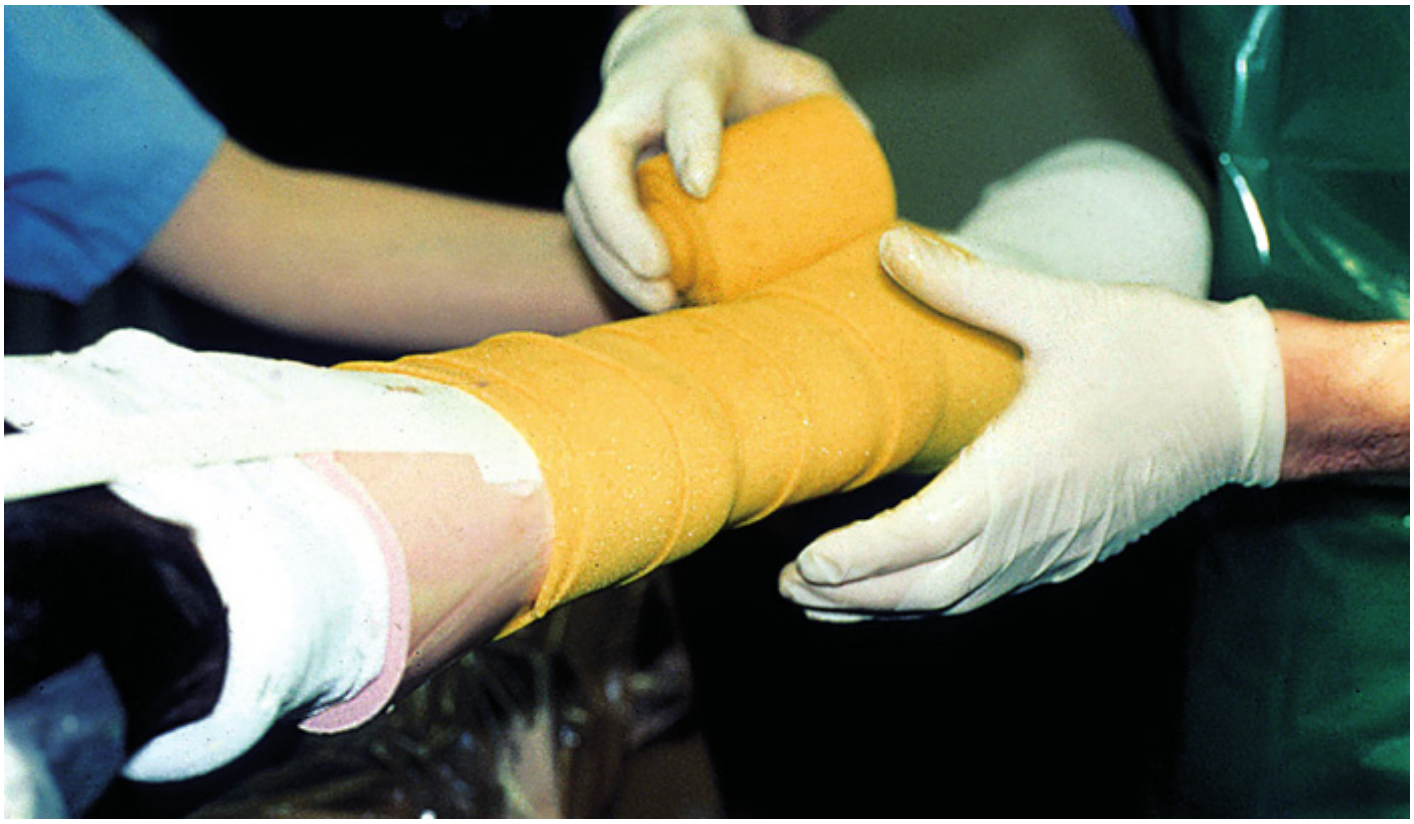

Figure 4. Distal limb cast application.

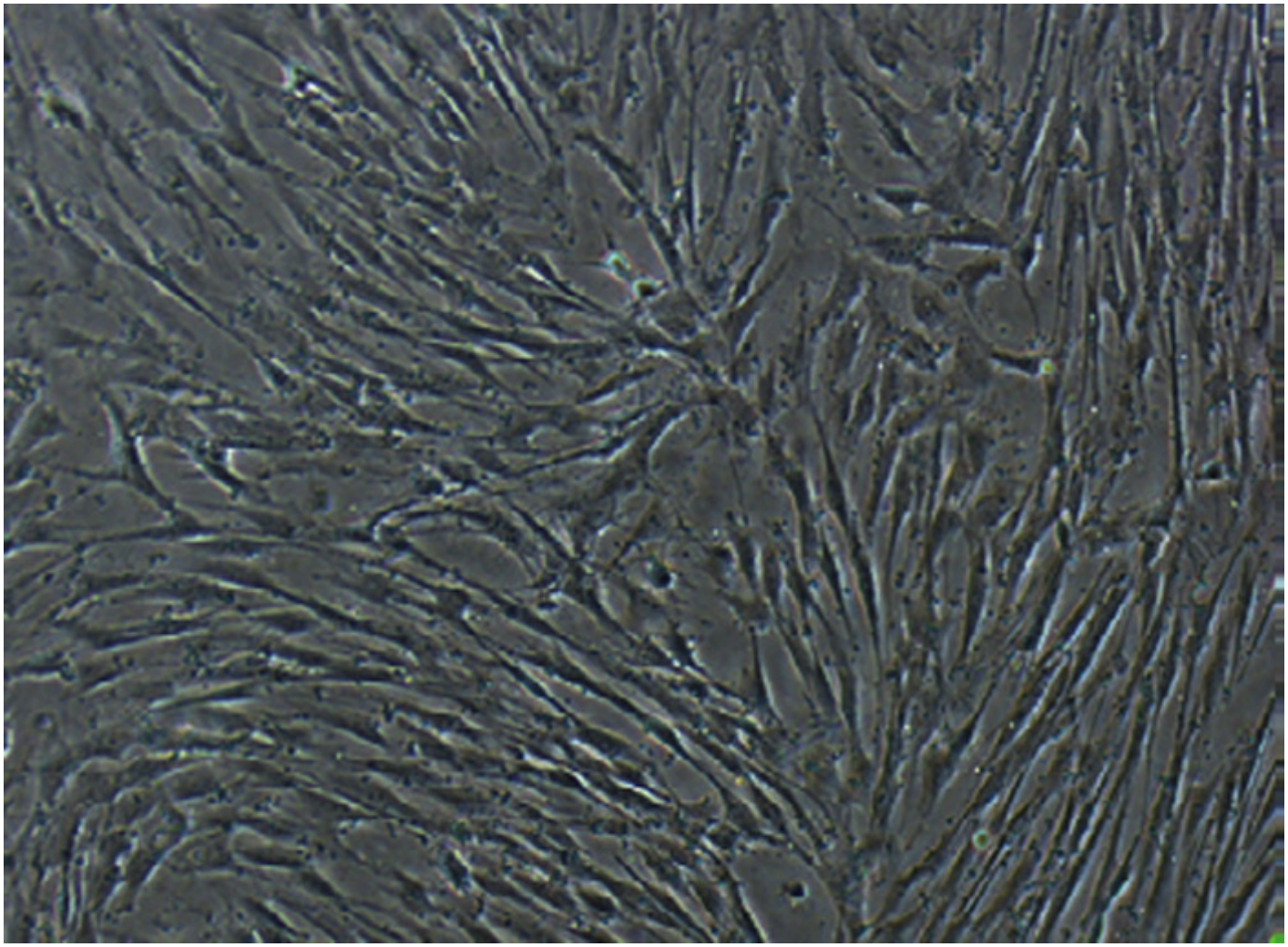

Figure 5. Mesenchymal stromal cells in culture prior to use for regenerative therapy.