The Royal Stoke Pin Site Care Pathway: Reducing Pin Site Infections Through Innovation.

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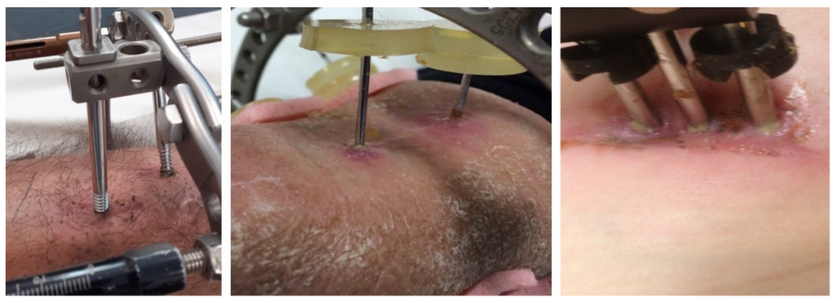
Introduction

Over the last 30 years of fracture management with external fixators at Royal Stoke University Hospital (RSUH) we have developed a pin site care pathway. It contains innovations to minimise the incidence of pin-site infections (PSI). Figure 1 illustrates the three states of a pin site[1]: calm, irritated and infected (Table 1 illustrates various grading definitions). The purpose of the pathway is to: 1) stop pin sites from becoming irritated and 2) prevent pin sites from transitioning from irritated to infected. In recent publications PSI incidence is quoted at between 10% and 40%[2-8], and as much as 100%[8]. This poster illustrates the impact that the development of our pathway has had on PSI at the Royal Stoke University Hospital.



(a) Calm (b) Irritated (c) Infected

Fig. 1 - Example of calm, irritated and infected pin sites[1]

Precis of The Royal Stoke Pathway

Pre-Operative: Typical patient assessment questions include: self-caring; mental health issues; mobility status; age; co-morbidities; how active will they be; length of treatment; type of frame; type of pin or wire; and whether a nurse-led clinic for weekly pin site care is required.

Peri-operative: No Tourniquet. Good drilling technique: new drill; one cortex at a tim; full forward drill speed, not reversed, on extraction (to bring out swarf); clean and cool after each cortex. Good wire insertion technique: pulsed not continuous drive; keep wire cool; minimise skin tenting. Fixator: wire, pin and overall frame stability; adequate number of pins or wires. Individual *Charnley Sponges* soaked in *chlorhexidine* applied to each pin-site with compression using a dressing retainer. For all dressings compression is required to minimise skin movement as well as holding the dressing in place. Post-operative, this also helps to reduce bleeding and haematoma formation.

Post-operative (Day 8-15 or first appointment): The Charnley sponges are removed. The pin-sites are cleaned using an aseptic technique (*normasol* and sterile gauze). A double layer, Hydrophilic Polyurethane Matrix (HPM) dressing is applied to each pin-site and light compression applied using a retainer (Figure 2). Patients, their relatives, and carers are taught how to successfully perform pin-site care. They are taught how to clean and redress their pin-sites (following the RCN Pin-Site Consensus Guidelines[1]). We suggest the patient clean and redress weekly (we recommend the use of Hydrex solution 0.5% as the cleansing agent). At each dressing change it is important that the retainers are clean and disinfected. All patients are taught the three states of a pin-site (Figure 1). They are also taught what to do if they develop irritated or infected pin-sites (Figures 1 (b) and (c)). A pin site care pack is supplied. Patients are informed to keep the limb dry. No bathing is allowed. Showering is permitted, prior to dressing change and with dressings in place, once a week only . All patients are seen in routine outpatients' clinics every four to six weeks; this is part of their normal treatment programme.

The Royal Stoke run nurse-led clinics for patients with complications: for those who cannot manage their own pin-site care or who have pin site problems. A telephone triage system runs Monday to Friday during normal hours. Patients can obtain immediate advice if a complication or a concern arises. All orthopaedic outpatient nursing staff have been trained to follow a clinical pathway and can give advice. If deemed necessary, the patient may be seen within 24 hours.

Irritated pin-sites are treated with an Inadine dressing under new HPM dressings (Figure 3) with light compression using a retainer. The dressings are changed, up to, twice daily: the limb should be elevated and rested until the irritation subsides. If a pin-site infection develops (Figure 1(c)) a silver dressing is prescribed and used as with the Inadine dressing. We suggest that the infected pin-site is always the last to be cleaned and the retainer must not be used on another pin-site. Pin-site care is elevated to 2-3 times weekly until the infection subsides.

Fixator removal: Normally, the fixator is removed using aseptic technique. This is performed in outpatients and without the need for general anaesthesia (patients treated with olive wires require an operation to remove the fixation). The pin-sites are prepared and dressed with sterile gauze (sutures are not required) and protected with a wool and crepe bandage.

Patients are also informed to keep their limb dry for a minimum of 3 days. Depending on the initial procedure, patients are advised to partial weight bear, with crutches, until seen two-weeks post fixator removal. After 3 days the bandage is removed at home. If the pin-sites are dry, patients are allowed to bathe or shower, and re-dressing is not required. If the pin-sites are still moist, patients are allowed to shower only and redress using sterile dressings.

Table 1 – Pin site definitions (adapted from Kazmers *et al.*[2])

Ward[3]	Saleh and Scott[4]	Checketts *et al.* [5]	Dahl *et al.*[6]	McBride[7] and RCN[1]
Redeemable with care				
Minor—Prolonged drainage, crusting, swelling, and erythema. Considered benign.	Grade 0—No problems.		Grade 0—Normal. Treat with weekly pin-site care.	THE CALM PIN-SITE-no redness, no exudate, no pain, looks just like an ear piercing. Weekly pin-site care.
	Grade 1—Responds to local treatment, increased cleaning, and massage		Grade 1—Inflamed. Daily pin-site care.	THE IRRITATED PIN-SITE-redness, painful, sometimes itchy and oozing exudate but NO pus. Daily pin-site care (Inadine with HPM dressings).
		Grade 1—Slight erythema, little discharge. Treat with improved local pin-site care		
	Grade 2—Responds to oral antibiotics	Grade 2—Erythema, discharge, pain, warmth. Treat with improved local -site care and oral antibiotics	Grade 2—Serous drainage. Antibiotics.	MILD INFECTED PIN-SITE-redness, painful, oozing pus. Silver with HPM dressings changed 2-3 times per week.
	Grade 3—Responds to intravenous antibiotics or pin releases	Grade 3—As per grade 2, but no improvement with oral antibiotics. Pins/ex fix can be continued.	Grade 3—Purulent discharge. Antibiotics.	MODERATE TO SEVERE – redness, very painful, extreme pus. Silver with HPM dressings changed 2-3 times per week / Oral ABx or IV ABx.
Catastrophic				
		Grade 4—Severe soft tissue infection involving several pins ± pin loosening. Ex fix must be discontinued.		Removal of wire/pin if no response to above.
Major—Resolution requires removal of affected pins..	Grade 4—Responds to removal of the pin.	Grade 5—As per grade 4, but with bone involvement visible on radiographs. Ex fix must be discontinued.	4—Osteolysis. Pin removal.	
	Grade 5—Responds to local surgical curettage.	Grade 6—Major infection occurring after ex fix removal. Treatment requires curettage of pin track.	Grade 5—Ring sequestrum. Debridement.	

Fig. 2 – Example of dressing / compression device combination

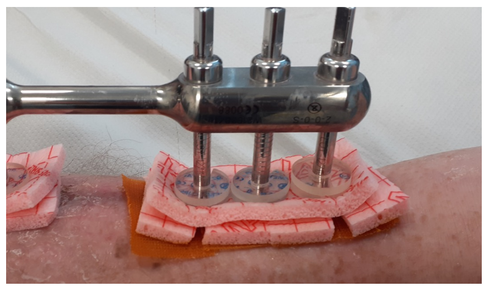


Fig. 3 – Example of inadine / dressing / compression combination

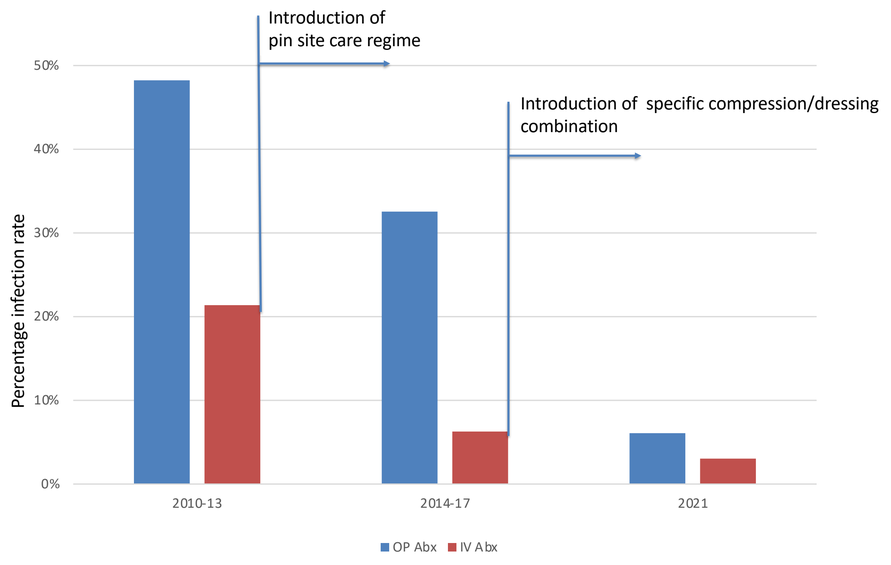


Fig. 4 – Reduction in infections to near zero since 2010

(2010-13 to 2014-17 OP ABx p = 0.062 IV Abx p = 0.006)

Discussion of Results

Figure 4 illustrates the results of a retrospective analysis of a registered data review of all patients whose lower limb had been treated using an external fixator over the period 2010-2021. Prior to 2013 the incidence of PSI was similar to that presented in the literature[8].In 2013 the pin site care regime was introduced, in 2017 the new dressing/clip combination was introduced. The reduction in IV antibiotics between 2010/13 and 2014/17 is significant (p=0.006), the reduction in oral antibiotics is not significant (p=0.062). Only one data set, for the year 2021 is presented: but the data shows a large reduction in administered antibiotics. For 2021, infections were only recorded in two patients: a patient with diabetic peripheral neuropathy; and a patient with an existing oral infection and unstable wires in the foot. However, the infection rates since the introduction of the Royal Stoke Pathway are much lower than reported in recent literature[8].

References

1: RCN (2022) Guidance on Pin Site Care
2: Kazmers, N.H., Fragomen, A.T. and Rozbruch, S.R., 2016. Prevention of pin-site infection in external fixation: a review of the literature. *Strategies in Trauma and Limb Reconstruction*, *11*(2), pp.75-85.
3: Ward P (1998) Care of skeletal pins: a literature review. Nursing Standard 12(39):34–38
4: Saleh M, Scott B (1992) Pitfalls and complications in leg lengthening: the Sheffield experience. Seminar Orthopaedics 7(3):207–222
5: Checketts R, Moran C, MacEachern A, Otterburn M (1999) Orthofix external fixation in trauma and orthopaedics. Pin track infection and the principles of pin-site care. Springer, London
6: Dahl MT, Gulli B, Berg T (1994) Complications of limb lengthening. A learning curve. Clin Orthop Relat Res 301:10–18
7: McBride,A & Ogrodnik, P (2016). *Pin-site care and innovations in management.* Orthopaedic & Trauma Alliance Annual Meeting, Blackpool.
8: Shields, D.W., Iliadis, A.D., Kelly, E., Heidari, N. and Jamal, B., (2022). Pin-site Infection: A Systematic Review of Prevention Strategies. *Strategies in Trauma and Limb Reconstruction*, *17*(2), p.93.

Acknowledgements

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Conflicts of Interest

The authors are co-inventors of a dressing clip distributed by Metaphysis LLP