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APPENDIX – SEARCH STRATEGY (NO PUBLICATION DATE LIMIT)

Ovid Medline – 120 references retrieved on 03/22/2018
 ((open adj3 fracture*).ab,ti. OR “Fractures, Open”.sh.)AND
 ((infection* OR sepsis OR contamination).ab,ti. OR Infection/ OR
 “Wound Infection”.sh. OR “Cross Infection”.sh. OR “Sepsis”.sh.)AND
 ((beads OR “bead chains” OR “vacuum assisted closure” OR VAC
 OR “vacuum sealing” OR gel).ab,ti. OR “Negative-Pressure Wound
 Therapy”.sh.)

Embase – 215 references retrieved on 03/22/2018
 ((open NEXT/3 fracture*):ab,ti OR ‘open fracture’/de)AND
 (infection*:ab,ti OR sepsis:ab,ti OR contamination:ab,ti OR ‘infection’/exp OR ‘wound infection’/de OR ‘cross infection’/de OR
 ‘hospital infection’/de OR ‘sepsis’/exp)AND
 (beads:ab,ti OR “bead chains”:ab,ti OR “vacuum assisted
 closure”:de,ab,ti OR VAC:ab,ti OR “vacuum sealing”:ab,ti OR gel:ab,ti)
CINAHL – 35 references retrieved on 03/22/2018
 ((open W3 fracture*) OR MH Fractures, Open)AND
 (infection* OR sepsis OR contamination)AND
 (beads OR bead chains OR vacuum assisted closure OR VAC OR
 vacuum sealing OR MH “Negative Pressure Wound Therapy”)

CENTRAL – 14 references retrieved on 03/22/2018 – in Title, Abstract, Keywords
 (open NEAR/3 fracture*)AND
 (infection* OR sepsis OR contamination)AND
 (beads OR “bead chains” OR “vacuum assisted closure” OR VAC OR
 “vacuum sealing” OR gel)



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QUESTION 3: Is there a difference in the risk of periprosthetic joint infection (PJI) with use of internal versus external fixation for treatment of periprosthetic fractures?

RECOMMENDATION: Unknown. There is limited evidence comparing the risk of PJI with use of internal versus external fixation to treat periprosthetic fracture. The potential for pin tract infection, particularly with inadvertently placed intra-articular pins, make internal fixation the preferable treatment option in most cases.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 90%, Disagree: 5%, Abstain: 5% (Super Majority, Strong Consensus)

RATIONALE

The majority of studies that have explored this question describe periprosthetic femur fractures after total knee arthroplasty (TKA). Periprosthetic femur fractures following TKA are an uncommon complication (0.3 to 2.5% incidence rate per year), but are occurring more frequently given the higher rate of primary TKA and increased activity of the elderly patients who are at the highest risk [1-3]. Treatment options currently include nonoperative management (protected weightbearing, bracing, casting), open reduction internal fixation (ORIF), or, rarely, external fixation [1,4]. Given the success of ORIF, there are few reports on the use of external fixation [1,2,4]. In addition, external fixation has historically been avoided given the belief that external fixation pins near a total joint increases the risk for superficial and deep infection [2].

Within this specific clinical setting, there is limited knowledge given the lack of large series of periprosthetic femur fractures treated with either internal or external fixation. The only reports of external fixation for these fractures are case reports. Based on the current literature, there is no difference in the rate of deep infection following internal fixation (rate = 4%) versus external fixation (rate = 7%, $p = 0.8$). This analysis is severely limited by the small sample

size, so it is difficult to make any definitive statement regarding the differential risk for PJI after internal or external fixation of periprosthetic fractures.

ORIF is preferred given its high rates of union and low rates of infection (~3%) [1,2,4]. For patients who are too ill or are contra-indicated for ORIF, treatment options include nonoperative management or external fixation. While the infection rate for nonoperative treatment is predictably low (0 to 1%), 31% of patients had complications related to malunion or nonunion [2,3]. Given this poor outcome, some have turned to external fixation [3,5-9].

A recent systematic review found that the rate of deep infection/PJI following ORIF was 4.1% (10 out of 245 reported patients). Among all published reports using external fixation, the rate of superficial pin site infection was 28.6% (4 out of 14 reported patients) and the rate of deep infection/PJI was 7.1% (1 out of 14 reported patients) [3,5-9]. The rate of PJI between internal versus external fixation was not statistically significant ($p = 0.8$ by chi-square test). Based on this data, the risk of PJI is not statistically significantly different following internal or external fixation of periprosthetic femur fractures, but this analysis is severely limited by small sample size.

There are only two case series that report on use of external fixation to treat periprosthetic fractures. Assayag et al. successfully treated two periprosthetic tibia fractures using a circular external fixation frame without superficial or deep infection [10]. Interestingly, Sakai et al. successfully treated an infected periprosthetic total hip arthroplasty femoral fracture with Ilizarov external fixation with resolution of the infection [11].

There has been no systematic study of this topic. Thus, it is therefore challenging to make a definitive statement regarding any possible differential risk for PJI after internal or external fixation of periprosthetic fractures. Internal fixation appears to be the preferable treatment method with a trend toward lower risk of PJI, as well as the potential for improved alignment and function with better reduction and fixation.

REFERENCES

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APPENDIX - SEARCH STRATEGY

Databases: OVID-Medline, Google Scholar, Scopus

1. "Periprosthetic Fractures"[MeSH] AND "Infection"[MeSH]) AND ("external fixation" or "internal fixation")
2. "infection" and "periprosthetic fracture" and ("internal fixation" vs. "external fixation")
3. "infection" and "periprosthetic hip fracture" and ("external fixation") - Nothing
4. "periprosthetic tibia fracture" and "external fixation" - 1
5. "periprosthetic femur fracture" and "external fixation" - 1

COMBINED ANALYSIS

Paper	N	Superficial Infection	Deep Infection
Beris	3	2	0
Figgie	1	1	1
Biswas	5	0	0
Merkel	3	0	0
Simon	1	1	0
Hurson	1	0	0
Summary	14	4 (28.6%)	1 (7.1%)

(p = 0.8; chi square result compared to results following ORIF)



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QUESTION 4: Should definitive fixation of fracture in a polytrauma patient and open abdomen be delayed until the abdomen is closed?

RECOMMENDATION: Definitive fracture fixation in the presence of an open abdomen should not be delayed and could be performed safely if the patient is suitable to undergo surgery.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 95%, Disagree: 5%, Abstain: 0% (Unanimous, Strongest Consensus)

RATIONALE

Laparotomy is a well-established intervention in a polytrauma patient aimed to achieve rapid hemostasis and limit the contamination generated by intestinal, biliary or urinary leak [1-3]. However, abdomen closure cannot be carried out until edema has resolved to allow tension-free closure [1]. It is known that delayed abdominal closure after damage-control laparotomy reduces mortality, complications and length of stay. Nonetheless, definitive abdominal closure is not performed until the requirement

for on-going resuscitation have ceased, no concerns regarding intestinal viability persist and no further surgical re-exploration is required [4]. Abdominal closure has been associated with fewer complications if performed within the the 4 to 7 days following laparotomy [4].

Early appropriate care of spine, pelvic ring, acetabulum and unstable femoral fractures in polytrauma patients decreases intensive care unit (ICU) length of stay from 9.4 to 4.5 days and total