Infection Following Open Ankle Fracture: The Predictive Value of Classification

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Introduction

Open fractures are devastating injuries that are associated with increased rates of infection. Many prognostic factors have been identified in an effort to better address the management of open fractures of the foot and ankle. Conventional ankle fracture classification systems describe osseous fracture orientation and mechanism of injury, but provide little in the way of infection risk.

Goal: Retrospectively evaluate the predictive power of commonly used ankle fracture classification systems in stratifying risk of infection following injury.
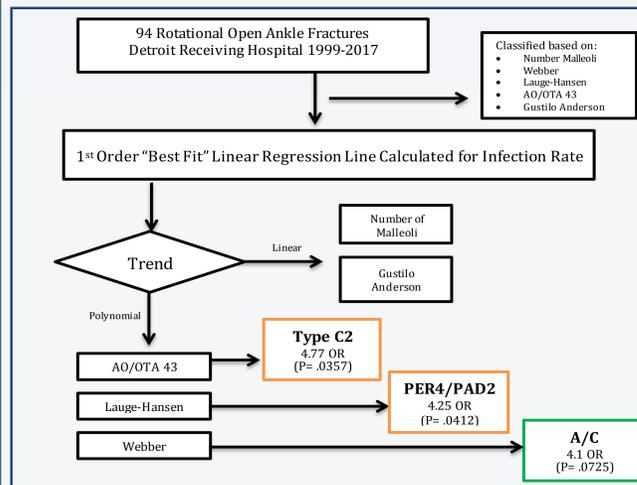
Fig 1. Flow sheet
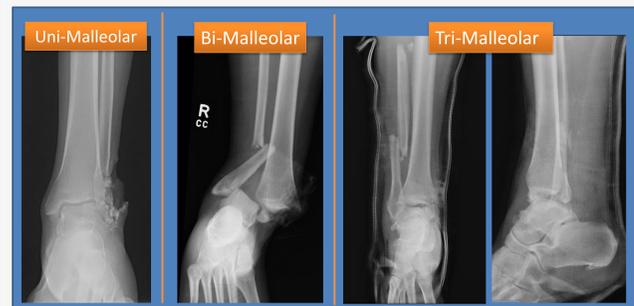
Fig 2. Pre-operative radiographs demonstrating number of malleoli

Methods

IRB Approval → 94 patients identified in EMR by ICD9 code.

3 blinded resident reviewers → retrospectively analyzed preoperative plain film radiographs → classified.

Incidence of Infection: One or more unplanned operations due to infection resulting from the fracture and sustained soft tissue trauma.

Inclusion:
- All patients 18 years of age or greater with a fracture of the talar articulating fibula or tibia with a break in the skin that communicated directly with the ankle joint were included.

Exclusion:
- Vulnerable populations and those with a follow up of < 3 months

Results

Fracture Type	Number of Fractures	Infections	Rate (%)
Number of Malleoli			
Unimalleolar	34	2	5.9
Bimalleolar	52	6	11.5
Trimalleolar	8	2	25
Weber Classification			
A	10	2	20
B	43	2	4.7
C	32	5	15.6
Lauge Hansen Classification			
SER 1, 2, 3, 4	1, 2, 2, 20	0, 0, 1, 1	8
PER 1, 2, 3, 4	1, 1, 3, 13	0, 0, 0, 3	16.7
PAD 1, 2	6, 8	1, 2	21.4
SAD 1, 2, 3	5, 8, 24	0, 1, 1	5.4
OTA Classfication 43			
A-1, A-2, A-3	13	1, 1, 0	15.4
B-1, B-2, B-3	41	1, 0, 1	4.9
C-1, C-2, C-3	32	0, 5, 0	15.6
Gustilo Anderson Classification			
1	8	1	12.5
2	23	2	8.7
3A	60	7	11.7
3B	2	0	0
3C	1	0	0

Table 2. Total fractures and infection rate by sub classification
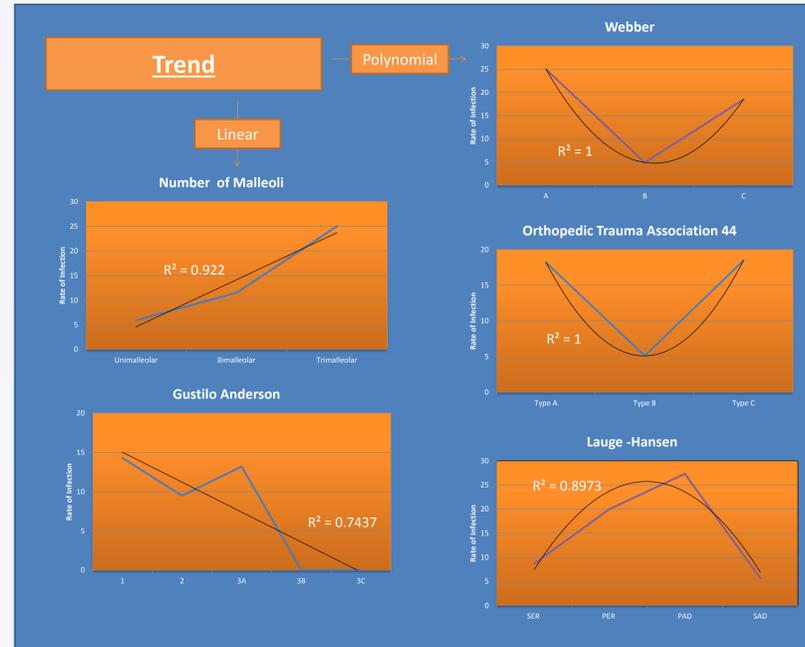
Fig 3. Aggregate infection rate and trend
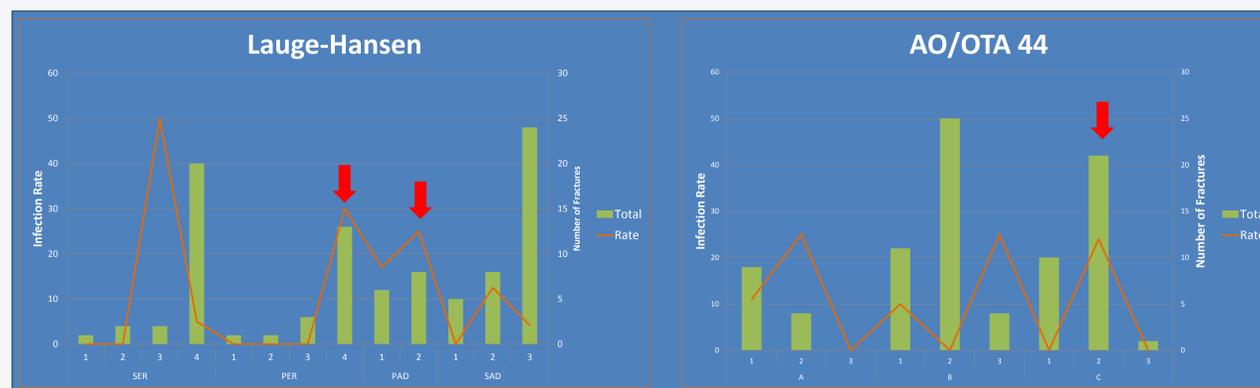
Fig 4. Sub-classification infection rate with identified significant values

Conclusion

- Near significant value (p=.0725) **Webber A/C** had an increased infection rate compared to B with an Odds Ratio of 4.1

- **Lauge – Hansen** and **OTA 44** had statistically significant outcomes

- **PER4/PAD2** and **Type C2** over 4 times more likely to become infected compared to remaining cohort

Lauge-Hansen	PER4/PAD2 Other	Odds Ratio 4.25	P = 0.0412
OTA 44	Type C2 Other	Odds Ratio 4.77	P = 0.0357
Webber	A/C B	Odds Ratio 4.1	P = 0.0725
Number of Malleoli	Uni/Bi Tri	Odds Ratio 3.25	P = 0.2014
Number of Malleoli	Uni Bi/Tri	Odds Ratio 2.46	P = 0.2227
Gustilo-Anderson	Type 3 Other	Odds Ratio 1.17	P = 0.5695

Table 3. Data analysis with 1 Tailed Fisher Exact test

Discussion

- The significant findings for Lauge-Hansen (PER4/PAD2) and OTA 44 (Type C2) classifications could compel alternative treatment regimens with an emphasis on infection prevention for the identified fracture patterns.
- Linear and polynomial trends were identified but have limited significance following statistical analysis

Limitations:
- Small sample size
- Statistical analysis

Future Work:
- Evaluate for confounding variables
- Prospective trials to verify findings
- Develop novel classification

Fig 6. Pre reduction radiograph

44-C   suprasyndesmotic lesion
44-C1 fibular diaphyseal fracture, simple
44-C2 fibular diaphyseal fracture, multifragmentary
44-C3 proximal fibular lesion
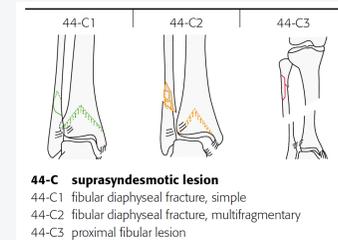
Fig 5. AO/OTA Fracture and Dislocation Classification 4-4

Fig 7. Clinical photograph of open ankle fracture and operative irrigation

References

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