Do Ankle Fracture Patterns Matter in the Predictability Incidence of Ankle Arthritis?

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Statement of Purpose

A common cause of ankle arthritis is post-traumatic, very often caused by ankle fractures. No literature has discussed if ankle fracture patterns have an effect on ankle arthritis. A retrospective analysis was preformed in displaced ankle fractures that underwent ORIF in our institution. A specific set of inclusion and exclusion criteria were created. Ankle fracture patterns were classified per Lauge-Hansen by two separate surgeons. **We proposed that PER ankle fractures patterns would have the highest predictability of ankle arthritis secondary to syndesmosis injury.**

Methodology & Hypothesis

A retrospective review revealed 205 ankle fractures were surgically fixed by ORIF by our institution between 2013-2017 using electronic medical records (EMR). A multitude of exclusion criteria were created to further promote results. Out of 205 patients, 62 met the inclusion criteria.

INCLUSION CRITERIA:
1. Ages between 21-75 were only considered
2. No open fractures were considered
3. No pilon fractures were considered
4. No ankle fracture that had a external fixator initially placed were considered
5. No prior history of ankle surgery were considered
6. No history of prior known ankle arthritis were considered
7. Patient had to be complaint in the post-operative period
8. Fracture union must have been achieved by 8 weeks

Radiographs were retrospectively reviewed and classified per Lauge-Hansen pre-operatively. Radiographs reviewed in the post operative period were examined for **subchondral sclerosis, joint space narrowing, and osteophyte formation.** Any presence of one of these factors were determined to be a predictability of ankle arthritis. We hypothesized that Lauge-Hansen PER ankle fracture patterns would have the highest predictability of ankle arthritis.

Procedure

Ankle fractures that underwent ORIF were identified using EMR. After proper classification pre-operatively, the patients that met the inclusion criteria were followed for a minimum period of 6 weeks. Radiographs post-operatively were inspected for subchondral sclerosis, joint space narrowing, and osteophyte formation.

PER 4 Example   SER 4 Example

Literature Review

It is well documented and researched that ankle arthritis is a common sequela of ankle fractures and trauma. Many have investigated which factors cause or can cause post traumatic osteoarthritis. No literature has reviewed any short term predictors that can cause ankle arthritis, but other variables have been examined in the long term.

Egol examined the predictors of short-term outcome of 198 patients undergoing ORIF for an ankle fracture. His group showed that patients under the age of 40 predicted satisfactory functional recovery at 6 months compared to patients who were older than 40. After 1-year follow up, functional recovery remained similar and age was not a factor.[1] They did not examine a link between age and ankle arthritis.

Saltzman retrospectively reviewed 639 cases of ankle arthritis and determined that 70% of patients with osteoarthritis were post-traumatic. They determined that the three most common causes of post-traumatic arthritis were rotational ankle fractures (37%), recurrent ankle instability (14.6%), and history of a single sprain with continued pain (13.7%) showing that ankle fractures were the most common.[2]

Horisberger retrospectively examined 257 end-stage ankle arthritis patients who presented to the author's clinic. OA latency time, fracture type, treatment methods, complication of fracture healing, soft tissue situation, age, pain score, range of motion, radiologic tibiotalar alignment, and radiologic ankle OA grading were evaluated. The latency time between injury and end-stage ankle OA was 20.9 years (1-52 years). Malleolar fracture was the most common fracture (53.2%). He determined that fracture severity and OA latency were directly correlated.[3]

Results

AGE	FX TYPE	INJURY DATE	DAY OF SURGERY	DATE OF OSSEOUS HEALING	ARTHRITIC CHANGES?	FOLLOW UP IN WEEKS
55	SER4	6/16/15	6/24/15	7/23/15	NO	6
73	SER4	3/1/12	3/8/12	5/16/12	YES	18
43	PER3	10/10/15	10/22/15	12/19/15	NO	10
50	SER3	3/27/17	4/6/17	6/15/17	YES	10
24	SER4	4/11/17	4/12/17	5/25/17	NO	16
54	SER4	12/12/15	12/17/15	2/22/16	NO	32
65	PER3	5/22/17	5/25/17	7/7/17	NO	10
52	SER2	8/21/12	8/27/12	10/1/12	NO	16
36	SER2	8/2/15	8/6/15	9/24/15	NO	8
34	SER2	1/15/14	1/22/14	2/26/14	NO	11
54	SER4	4/25/12	4/30/12	6/15/12	NO	32
38	SER4	10/31/15	11/5/15	12/21/15	NO	8
42	SER2	10/27/13	10/31/13	12/18/13	YES	18
50	SER4	3/17/14	3/24/14	5/6/14	NO	8
51	PER3	11/2/13	11/13/13	2/12/14	NO	12
37	SER2	11/11/13	11/14/13	1/31/14	YES	10
58	SER4	5/15/16	5/18/16	7/18/16	NO	10
48	SER2	12/27/13	1/2/14	3/4/14	NO	12
54	SER2	12/6/16	12/8/16	2/21/17	NO	10
31	SER2	11/7/14	11/12/14	1/6/15	YES	12
56	SER2	10/9/15	10/13/15	11/30/15	YES	43
46	PER4	4/5/17	4/12/17	5/26/17	NO	12
49	PER4	1/2/14	1/6/14	3/4/14	YES	54
54	SER2	11/19/14	11/26/14	1/29/15	YES	26
38	SER4	2/27/16	3/14/16	5/26/16	NO	12
44	SER2	2/3/15	2/12/15	3/30/15	NO	11
41	SER2	6/8/14	6/12/14	8/4/14	NO	11
59	SER2	2/21/15	3/2/15	5/5/15	NO	124
52	SER2	7/6/15	7/9/15	9/9/15	NO	19
49	SER2	2/1/15	2/17/15	4/15/15	YES	14
32	SER2	9/12/15	9/16/15	12/1/15	NO	14
47	SER2	12/28/15	1/4/16	2/23/15	NO	48
30	SER4	4/30/15	4/30/15	6/16/15	NO	45
44	PER4	9/14/16	9/19/16	11/15/16	YES	13
30	SER2	9/14/15	9/21/15	11/3/15	NO	6
31	SER4	1/18/16	1/21/16	3/8/16	YES	30
35	SER4	4/22/16	4/28/16	6/10/16	NO	10
38	SER4	5/15/16	5/19/16	7/26/16	NO	10
42	SAD2	8/1/15	8/6/15	9/25/15	YES	24
58	SER2	4/16/16	4/18/16	6/3/16	YES	60
28	SER2	1/7/16	1/20/16	3/3/16	NO	12
56	SER4	1/2/16	1/14/16	2/26/16	NO	10
36	SER2	6/5/15	6/11/15	7/24/15	NO	10
36	PER4	3/22/16	3/24/16	5/27/16	YES	25
28	SER2	1/1/16	1/7/16	3/2/16	NO	64
35	SER2	2/10/15	2/25/15	3/12/15	NO	27
28	SER4	2/2/16	2/4/16	3/16/16	NO	8
30	SER4	12/20/15	12/23/15	3/31/16	NO	10
45	SER4	9/20/16	9/21/16	10/27/16	NO	18
37	PER3	9/24/16	10/5/16	11/28/16	YES	14
36	PER4	5/31/16	6/8/16	7/21/16	NO	11
59	SER4	3/21/16	4/6/16	5/19/16	YES	22
49	SER4	7/10/15	7/16/15	8/28/15	NO	106
51	SER4	1/5/15	1/8/15	3/9/15	NO	10
54	PER4	2/16/16	3/2/16	4/19/16	YES	80
51	SER4	3/8/15	3/12/15	4/27/15	NO	13
27	PER4	11/16/15	11/25/16	1/5/16	NO	10
50	SER4	6/12/16	6/18/16	8/5/16	NO	8
44	SER4	8/12/16	8/18/16	9/27/16	YES	8
60	SER4	8/19/16	8/25/16	11/1/16	YES	15
60	SER2	2/5/15	2/26/15	4/15/15	YES	13
28	SER4	8/13/16	8/18/16	10/6/16	NO	10

62 TOTAL ANKLE FRACTURES		OLDEST PATIENT 73 YEARS OLD	SHORTEST FOLLOW UP 8 WEEKS
50 SER		YOUNGEST PATIENT 21 YEARS OLD	LONGEST FOLLOW UP 124 WEEKS
11 PER			
1 SAD		AVERAGE AGE 45 YEARS OLD	AVERAGE FOLLOW UP 22 WEEKS
	62 ANKLE FRACTURES	5/11 PER YES	45%
	20 YES FOR ARTHRITIS	1/1 SAD YES	100%
	42 NO FOR ARTHRITIS	14/50 SER YES	28%

Analysis & Discussion

Out of 62 ankle fractures reviewed pre-operatively, 50 were Supination-External Rotation, 11 were Pronation-External Rotation, and 1 was Supination-Adduction.

After ORIF, 45% of PER, 100% of SAD, and 28% of SER ankle fractures showed evidence of early onset post traumatic arthritis in the post operative period per radiological diagnosis with the use of the designated criteria.

A **Z-test** was utilized comparing the proportions of two populations showing arthritic changes after their resultant type of fracture; **SER and PER fracture patterns. P-value was determined to be 0.457.**

There was not a significant difference in the proportions of individuals with the characteristic of interest within the two groups (P = 0.457).

Age could be a factor in the incidence of ankle arthritis, but there are been studies to show age did not have a predictor at at the one year follow-up mark.

Some literature did examine a link between ankle trauma severity (pilon fractures) and long term ankle arthritis which did show that more severe ankle trauma can lead to ankle arthritis at a quicker rate.

Post-traumatic ankle arthritis remains a common sequela after ankle fracture ORIF. There has been little discussion in the literature in regards to which Lauge-Hansen fracture pattern has the highest link to progressive ankle arthritis. In our study, it showed that PER fracture patterns had the highest incidence of predictability of arthritis. Although the P-value showed that it was not significant, further study, follow-up, and a larger population size would need to be investigated.

References

1- Egol K, Tejwani N, Walsh M, Capla E, Koval K. Predictors of short-term functional outcome following ankle fracture surgery. J Bone Joint Surg (Am) 88:974–979, 2006.

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