

57 - Infection and Immune Reaction After Achilles Repair: A Systematic Review

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Disclosures

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Objectives

- Achilles tendon rupture is among the most common tendinous injuries in athletes
- Surgeries in and around the ankle have been reported to have higher rates of infection relative to other common orthopedic sites
- The Achilles tendon has been reported to be infected with unique microorganisms compared to other sites
- The unique pathogens reported in Achilles infections have been reported individually in the literature, but no systematic review has been conducted to assess the prevalence of different infectious agents in post-operative Achilles infections
- Despite the affect infection and post-operative complications can have on recovery, the literature is sparse regarding timeline, infectious etiology, and surgical and patient risk factors implicated in post-operative Achilles infections
- The purpose of this study is to systematically review the literature regarding infections following Achilles tendon reconstruction

Methods

- An electronic review was conducted via PubMed and Cochrane search
- Search terms:** ("Achilles Tendon" OR "Achilles") AND ("Infection" OR "Bacteria" OR "Microorganism" OR "Complications")
- Inclusion Criteria:**
 - Study participants may be male or female patients who have undergone operative Achilles repair
 - All levels of evidence
 - Studies must be reported in the English language
 - Studies must be conducted in the United States or Non-U.S. countries that offer the same treatment strategies available in the US
 - Observational and randomized control trial designs
 - Any time period
- Exclusion Criteria:**
 - Studies that do not discuss postoperative infection after Achilles repair
 - Studies not reported in the English language
- Information extracted if available in literature include:**
 - Incidence of Achilles infection
 - Patient age
 - Patient risk factors
 - Surgical risk factors
 - Time course of infection
 - Causative microorganism
 - Infected surgical material
 - Patient treatment
 - Time course of recovery
 - Whether secondary repair was needed

Results

Table 1: Etiology of infections from all studies where pathogens were cultured

Infectious microorganism	Number of cultures	Percentage of all cultured microorganisms
ALL CASES	23	
GRAM POSITIVES	Total=58	69.74%
<i>Cutibacterium (Propionibacterium) acnes</i>	2	2.20%
<i>Diphtheroids</i>	1	1.10%
<i>Enterococcus faecalis</i>	2	2.20%
<i>Coagulase Negative Staphylococcus</i> (11 S. epidermidis, 3 unspecified, 1 S. bovis, 1 S. gallinarum)	18	19.78%
<i>Staphylococcus aureus</i>	10	32.87%
<i>Streptococcus anginosus</i>	1	1.10%
<i>Streptococcus G</i>	2	2.20%
<i>Streptococcus viridans</i>	1	1.10%
<i>Trichobacterium vulvae</i>	1	1.10%
GRAM NEGATIVES	Total=31	34.87%
<i>Acinetobacter baumannii</i>	2	2.20%
<i>Bacteroides</i>	1	1.10%
<i>Enterobacter aerogenes</i>	4	4.40%
<i>Enterobacter cloacae</i>	2	2.20%
<i>Escherichia coli</i>	9	9.89%
<i>Pseudomonas aeruginosa</i>	12	13.23%
<i>Serratia marcescens</i>	1	1.10%
FUNGI	Total=2	2.20%
<i>Candida spp.</i>	1	1.10%
<i>Mucormycosis</i>	1	1.10%
Dysbiosis/Nil	22 cases	

Table 2: Factors associated with increased risk of infection after operative Achilles repair

Patient Risk Factor	Study	Odds Ratio	P-Value
Open wound or prior infection	Hassain et al.	25.062	P<0.001
Obesity	Marian et al., Domitrowski et al.	2	P<0.0001
Age	Hassain et al., Fajala et al.	1.0303 for each additional year of age	P=0.03
Corticosteroid	Fajala et al.	-	-
Tourniquet times	Jideh et al.	-	P=0.04
Blood loss	Jideh et al.	-	P=0.02
Smoking	Jideh et al.	-	P=0.02

Results

- 34 articles met inclusion criteria including 23 clinical studies, 10 case studies and 1 systematic review
- Out of 91 total cases, *Staphylococcus aureus* (32.97%), coagulase negative *Staphylococci* (19.78%), and *Pseudomonas aeruginosa* (13.19%) together constituted 64.4% of cultured organisms
- In the 6 studies comparing open vs minimally invasive repair, 2 studies found that open had a statistically significant increase in post-operative complications including infections, while 4 studies found no significant increase
- Greatest risk factors for infection were open wounds prior to surgery (P<0.001), obesity (P<0.0001), and age (P=0.03)
- In the 10 studies reporting time to infection, timing spanned from 10 days up to 6 months, with 6/10 cases occurring in the first 8 weeks

Conclusion

- Achilles tendon rupture is one of the most common tendinous injuries and causes significant functional disability often requiring surgical repair
- There is a relative lack of specificity in the literature regarding time to infection, causative agent, and time to infection resolution
- Future work should focus on larger cohort assessment and identification of infectious agents and course

References

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- **Exclusion Criteria:** Studies that do not discuss postoperative infection after Achilles repair, Studies not reported in the English language
- **Information extracted if available in literature include:** Incidence of Achilles infection , Patient age, Patient risk factors , Surgical risk factors , Time course of infection, Causative microorganism, Infected surgical material, Patient treatment, Time course of recovery , Whether secondary repair was needed

Results

- 33 articles were included. *Staphylococcus aureus*, coagulase negative *Staphylococci*, and *Pseudomonas aeruginosa* were the most common infectious agents making up 33.3%, 20%, and 13.3% of cases, respectively.
- The greatest risk factors were open wounds prior to surgery ($P < 0.001$), obesity ($P < 0.0001$), and age ($P = 0.03$).
- The time to infection ranged: 10 days-6 months, with most infections occurring within the first 8 weeks.

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Candida spp.	1	1.10%
Mucormycosis	1	1.10%
Polymicrobial	20 cases	

Patient Risk Factor	Study	Odds Ratio	P-Value
Open wound or prior infection	Hussein et al.	25.962	P<0.001
Obesity	Marican et al., Dombrowski et al.	2	P<0.0001
Age	Hussein et al., Pajala et al.	1.0303 for each additional year of age	P=0.03
Corticosteroid	Pajala et al.	-	-
Tourniquet times	Jildeh et al.	-	P=0.04
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Smoking	Jildeh et al.	-	P=0.02

Conclusions/Significance of the Findings

- Achilles tendon rupture is one of the most common tendinous injuries and causes significant functional disability typically requiring surgical repair to return to pre-operative athletic status.
- Due to the thinness of the skin and the relative avascularity surrounding the Achilles tendon, healing and immune function can be impaired creating a microenvironment that allows infectious pathogens to thrive in the setting of a postoperative infection.
- Staphylococcus and streptococcus were the most common causative agents of infection followed by E. coli and pseudomonas which mirrors the common pathogens identified in most surgical infections.
- Infections generally began within the first 8 weeks postoperatively, but the range of reported timelines spanned 10 days up to 6 months highlighting the need for continued vigilance and sterile wound care postoperatively.
- Several statistically significant risk factors for post operative Achilles infection identified include obesity, comorbid medical conditions, smoking, tourniquet time, blood loss, and patient age.

Questions?