

Pretibial Lacerations in Young Athletes: Evaluating Who is at Risk, and Methods in Reducing Infection

Meghan S. Dougherty¹ and Kim Bauer[#]

¹Pennsylvania Leadership Charter School, West Chester, PA, USA

[#]Advisor

ABSTRACT

This study begins research in identifying risks factors youth athletes face when it comes to their probability of getting a pretibial laceration; which is seen more often in elderly populations. The data of shin skin thickness in athletes and non-athletes were compared in this research, as well as methods to decrease rates of infection in pretibial lacerations. The hypothesis of this research is to test if youth athletes are the most susceptible to pretibial lacerations compared to youth non-athletes. Data showed that athletes have “thicker” skin than non-athletes, which meant that they had more muscle mass surrounding their tibia bone which meant they have less skin to protect their tibia which lead to increased risk of pretibial lacerations compared to other youth populations.

Introduction

Pretibial lacerations are seen as uncommon in youth populations and more common in elderly populations; there is little to no research on the differences between treating pretibial lacerations in these two populations, let alone treating it in young athletes. It is of great importance to research into the effects that pretibial lacerations can have on youth athletes because it has not been researched yet. Researching more into this would allow for doctors and athletes to become aware of specific reasons why this uncommon injury happens in youth and how to help prevent it. From being an athlete and having suffered from one distally based flap laceration and one vertical pretibial laceration, I noticed differences in the healing process of both lacerations. I also started to see other athletes have similar pretibial lacerations like mine, and I wanted to investigate to see if there were any additional risk factors athletes face in getting a pretibial laceration. Past studies have explained that elderly people and females are at greater risk to get a pretibial laceration because as they age, their skin loses collagen, making it more friable which results in a small injury to make the skin tear.¹ I collected data about the thickness of shin skin from 12 participants, 6 athletes and 6 non athletes. I also evaluated the probability of different types of pretibial lacerations to get infected, and how to prevent infection. I hypothesized that the female athletes' shin skin would be tighter and relatively thinner than the non-athletes' shin skin because athletes tend to have more muscle mass in their lower legs which results in less protection of the tibia bone.

Results and Discussion

To evaluate the difference in shin skin thickness between the athletes and non-athletes I used a variation of the skin-fold test, where I tested participants' thickness of their shin skin and predicted the risk of them to experience a pretibial laceration, using previous research about skin elasticity.² The thickness of their shin skin was rated on a scale of thin, medium, and thick. Thin skin was classified by skin that felt stretchy where you could easily pinch a lot of skin. Thick skin was determined by skin, that when pinched, was extremely difficult to be able to grab any loose skin. Medium skin was classified by simply being in between thin and thick skin. Participants included 6 female athletes ranging in

age from 13-16 and 6 non female athletes ranging in age 13-16. The twelve participants sat down on a flat surface with their legs straight out in front of them. Each participant’s skin was pinched on top of and on the sides of their tibia bone. The results were significant because more athletes than non-athletes were classified as having thicker skin than thinner skin. (Figure 1.1) These results are of great importance because they proved my hypothesis to be half correct. I predicted that the athlete's skin around the tibia bone would be tighter because of the increased muscle mass demonstrated in the surrounding areas compared to non-athletes. This part of the hypothesis was correct because it was much harder to pinch the athletes skin. Every athlete whose skin was classified as “thick” had little to no excess skin in that area making it incredibly difficult to pinch the skin. The surprising part is, that even though as the athlete's skin was being pinched it felt “thick” it actually may not have been as thick as it seemed. Meaning that since there is a lot of muscle mass in that area, when pinching the skin, the skin feels thicker because I was pinching the muscle and the skin together.

Out of the 6 total athletes 66.6% had thick skin while 33.3% had medium skin. Out of the 6 non athletes 50% had thin skin, 33.3% had medium skin, and only 16% had thick skin. From these observations, I discovered that athletes compared to non-athletes are at a greater risk of getting a pretibial laceration because of the following risk factors: (1) Athletes are exposed to more laceration threats such as heavy lifting equipment, ice skates, wooden beams and bars, or cleats. Which in turn, when hit to the tibia bone with force could cause a laceration. (2) Athletes tended to have more muscle mass which made the skin surrounding the tibia thinner and more susceptible to abrasion. (Figure 1.2)

| | Athletes | Thin Skin | Medium | Thick Skin |
|---|--------------|-----------|--------|------------|
| 1 | | | ✓ | |
| 2 | | | | ✓ |
| 3 | | | | ✓ |
| 4 | | | ✓ | |
| 5 | | | | ✓ |
| 6 | | | | ✓ |
| | Non-Athletes | Thin Skin | Medium | Thick Skin |
| 1 | | | ✓ | |
| 2 | | ✓ | | |
| 3 | | ✓ | | |
| 4 | | ✓ | | |
| 5 | | | ✓ | |
| 6 | | | | ✓ |

Figure 1.1: Talled results of the variation of skin fold test measuring whether participants' skin was thin, medium, or thick.

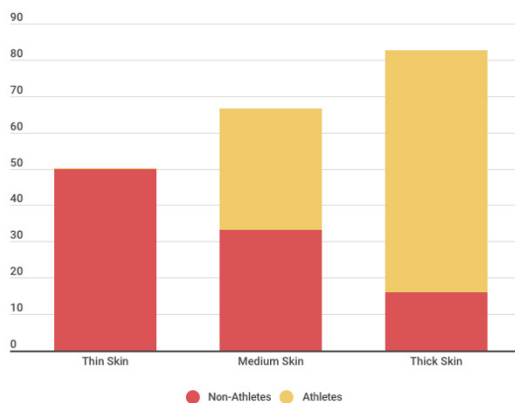


Figure 1.2: Comparison of the percentage thin, medium, and thick skinned youth athletes and non-athletes.

Comparison of Non-Athletes Skin and Elderly Skin

From previous research it is known that elderly people are at a greater risk for pretibial lacerations. This is because their skin sags and becomes more easily tear able because of the loss of collagen.¹ The thin skinned youth non-athletes and the elderly in sense have similar risk factors when it comes to getting a pretibial laceration but also have different risk factors which should be noted. We have to take into consideration that youth skin and elderly skin have different properties. When you are young your skin has tight bundles of collagen, but when you get older those collagen bundles start to wear away. Though thin skinned youth and elderly both had stretchy skin, the elderly population would have more of a risk of getting a pretibial laceration because their skin obtains less collagen then the youth.

Infection Rates of Pretibial Lacerations in Athletes

To evaluate pretibial laceration rates of infection specifically in athletes, I used my own personal data from my previous pretibial lacerations and data from past studies.³ The past research suggests that the main cause of infected sutures is bacteria like staphylococcus and streptococcus.⁴ I myself had a distally based flap laceration as well as a vertical slice pretibial laceration.⁵ I then used evidence from another young female athlete who had a proximally based flap laceration, so I would be able to investigate the three main types of pretibial lacerations according to *The British Journal of Hospital Medicine*.⁶ : Distally based flap, proximally based flap, and vertical slice.(Figures 1.3-1.4) Previous research has shown that proximally based flap lacerations tend to have good blood supply and a good diagnosis. While distally based flap laceration tends to have poor blood supply and have a poor prognosis. Vertical lacerations tend to have highest success rates in healing and decreased probability of infections and scarring.⁷ From the data collected by these three pretibial lacerations in young athletes, both the proximal and distal based flap lacerations got infected after suture removal, and the vertical laceration had no complications. (Figure 1.5)



Figure 1.3: Three main types of pretibial lacerations; via *The British Journal of Medicine*



Figure 1.4: Three main types of pretibial lacerations



Figure 1.5: Infected proximal and distal based flap pretibial laceration after suture removal and non-infected vertical laceration.

Though only three instances of pretibial laceration infections were studied, the results are significant. A previous study, conducted research on eighty-eight patients with pretibial lacerations and monitored their wound healing and infection rates.⁸ The infection rates were relatively low, with staphylococcus aureus being the most common pathogen. This research was conducted on mostly older adults or elderly patients. Even though pretibial lacerations are not as common in youth as older populations, if this research was conducted on active youth, the results most likely would have been the opposite; due to the three case studies investigated in my research. Most older adults and elderly patients live more sedentary lifestyles, so they are exposed to less infectious risk factors, which could suggest why they experienced low infection rates.

How to Decrease Infection Rates in Pretibial Lacerations in Young Athletes

Past research in post-suture wound care says that the timing of the suture removal is one of the most important factors in decreasing infection rates.⁹ Athletes tend to live an overly active lifestyle whether they are aware of it or not.¹⁰ This can lead to re-opening of the laceration after suture removal if sutures are not kept in long enough. From the data talked about earlier in this research, more athletes than non-athletes tended to have thicker skin, which as discussed, meant that they had more muscle surrounding their tibia bone which results in less protection of the tibia because the skin is being tightened and therefore “thinned” out because of the extra muscle. Due to the tibia bone having less skin around it to be protected, it resulted in more problematic healing. As seen in figure 1.5 , not having a lot of skin in the pretibial area can cause lacerations to re-open and get infected. Doctors should be informed about the differences in treating pretibial lacerations in athletes vs. non-athletes because of the less skin they have protecting their tibia and their high risk of infection.

Conclusion

Throughout this research the thickness of athletes versus non-athletes skin were studied, as well as the infection rates of the three main pretibial lacerations: distally based flap proximally based flap, and vertical laceration, as well as ways to help decrease infection rates. The data was analyzed and it was concluded that youth athletes have a higher risk of getting a pretibial laceration than non-youth athletes. More athletes demonstrated to have thicker skin, compared to the non-athletes. Even though the athletes had thicker skin, they had more muscle mass around their tibia bone which in a sense, seemed to stretch their skin and make their tibia bone less protected. One case study of each of the three main pretibial lacerations were studied. It was concluded that the distal and proximal based flap were the most susceptible to infection in youth athletes. They showed the higher rates of infection because since the skin was lacerated horizontally, and from the data conducted in this study, the youth athletes demonstrated having less skin around their tibia, so after suture removal, the lacerations re opened and infection occurred. It is significant to note that athletes compared to non-athletes would have more of a risk of having their pretibial laceration re-open after

suture removal due to the intensity of their lifestyle. It is important that more research is conducted in pretibial lacerations in athletes, such as return to sport guidelines and timing of suture removal. Further research is necessary in collecting the most accurate data. Future studies could perform tests on male and female youth athletes to obtain more data; as well as create a study with only youth patients with different types of pretibial lacerations and monitor healing and infection rates and compare those results with elderly populations.

Acknowledgments

Thank you to the anonymous students who participated in my research project. My project could not have been completed without your contributions.

References

1. Crawford, B. S. [https://www.jprasurg.com/article/0007-1226\(77\)90019-4/pdf](https://www.jprasurg.com/article/0007-1226(77)90019-4/pdf) (accessed Jul 11, 2021).
2. Duo Li University of British Columbia; Li, D.; Columbia, U. of B.; Profile, U. of B. C. V.; Shinjiro Sueda University of British Columbia; Sueda, S.; Debang R. Neog University of British Columbia; Neog, D. R.; Dinesh K. Pai University of British Columbia; Pai, D. K.; Contributor Metrics Expand All Duo Li The University of British Columbia Publication Years2013 - 2013Public; Duo Li The University of British Columbia Publication Years2013 - 2013Publication counts1Available for Download1Citation count57Downloads (cumulative)817Downloads (6 weeks)10Downloads (12 months)59Average Citation ; Authors: Duo Li University of British Columbia University of British Columbia View Profile. Thin skin elastodynamics. <https://dl.acm.org/doi/10.1145/2461912.2462008> (accessed Jul 11, 2021).
3. Singer AJ;Quinn JV;Thode HC;Hollander JE; ; Determinants of poor outcome after laceration and surgical incision repair. <https://pubmed.ncbi.nlm.nih.gov/12142655/> (accessed Jul 11, 2021).
4. A general approach to managing infected wounds and when to remove sutures . <https://bpac.org.nz/BPJ/2016/July/docs/BPJ76-correspondence.pdf>.
5. <https://www.instagram.com/sarasigmunds/?hl=en> (accessed Jul 11, 2021).
6. British Journal of Medicine. Pretibial Lacerations. <https://www.magonlinelibrary.com/doi/abs/10.12968/hmed.2017.78.11.C162>.
7. Caron Ireland. <https://go.gale.com/ps/i.do?id=GALE%7CA159862882&sid=googleScholar&v=2.1&it=r&linkaccess=fulltext&issn=13545752&p=AONE&sw=w&userGroupName=anon%7Eea957e71>.
8. DC;, W. R. A. W. M. A. B. W. A. S. Wound healing and infection in pretibial lacerations. <https://pubmed.ncbi.nlm.nih.gov/2029134/> (accessed Jul 11, 2021).
9. Gp. Reducing infection risk from stitches - the basics. <https://www.gponline.com/reducing-infection-risk-stitches-basics/article/763869> (accessed Jul 11, 2021).
10. Melekoğlu, T.; Sezgin, E.; Işın, A.; Türk, A. The Effects of a Physically Active Lifestyle on the Health of Former Professional Football Players. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6524351/> (accessed Jul 11, 2021).