ORIGINAL ARTICLE

ANALYSIS OF EXTREMITY FOREIGN BODY INJURIES

Ekstremite Yabancı Cisim Yaralanmalarının Analizi

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ABSTRACT

Objective: Extremity foreign body injuries are common in trauma departments. In this study, we aimed to find a relation to demographics, treatment methods, injury characteristics, environmental and injury conditions so that prevention methods could be more effective.

Material and Methods: Hospital digital archives were searched between July 2014 and March 2020 retrospectively and 146 patients were included. The demographic information, injury place, injured extremity with side, foreign body type and opacity, presence of infection, type of anesthesia performed, operation time, incision length were recorded. Data were analyzed statistically.

Results: The mean age of the patients was 25.9 ± 17.99 (2-78). According to gender and side examination, 90 patients were male and 56 patients were female. Metallic object and bullet injuries were mostly seen in males and needle injuries were mostly seen in females. Injuries caused by metallic objects were significantly more common in the upper extremity (p: 0.001). Glass and needle injuries were seen significantly as indoor injuries; as well as bullet, wooden part, and metallic part injuries were seen as outdoor injuries (p<0.001). The infection rate was significantly higher in outdoor injuries (p: 0.006). Age (p: 0.005), operation time (p: 0.007) and incision length (p: 0.019) were significantly higher in outdoor injuries. Indoor injuries were significantly higher under 18 years of age (p:0.036). There was a significant correlation between upper extremity injury and age (r: 0.358, p <0.001) and between upper extremity injury and male gender (r: 0.241, p: 0.003).

Conclusion: Foreign body injuries are common injuries seen in wide age range. Antibiotic prophylaxis and tetanus vaccine should be applied as primary care. Since firearm injuries, wooden part injuries, and injuries in the rural environment are found to be associated with infection, further studies are needed to discuss extending the duration of antibiotic prophylaxis in these cases.

Keywords: *Foreign Body, Extremity, Infection, Removal, Injury*

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ÖZET

Amaç: Ekstremite yabancı cisim yaralanmaları travma bölümlerinde sık görülmektedir. Bu çalışmada, önleme yöntemlerinin daha etkili olabilmesi için demografik özellikler, tedavi yöntemleri, yaralanma özellikleri, çevresel ve yaralanma koşulları ile bir ilişki bulmayı amaçladık.

Gereç ve Yöntemler: Hastane dijital arşivleri Temmuz 2014 ile Mart 2020 tarihleri arasında geriye dönük olarak tarandı ve 146 hasta dahil edildi. Demografik bilgileri, yaralanma yeri, yanı olan ekstremite, yabancı cisim tipi ve opaklığı, enfeksiyon varlığı, uygulanan anestezi tipi, ameliyat süresi, kesi uzunluğu kaydedildi. Veriler istatistiksel olarak analiz edildi.

Bulgular: Hastaların yaş ortalaması 25,9 ± 17,99 (2-78) idi. Cinsiyet ve yan muayeneye göre 90 hasta erkek, 56 hasta kadındı. Metalik cisim ve mermi yaralanmaları daha çok erkeklerde, iğne yaralanmaları ise kadınlarda daha sık görüldü. Metalik cisimlerin neden olduğu yaralanmalar üst ekstremitede anlamlı olarak daha yaygındı (p: 0,001). Cam ve iğne yaralanmaları iç mekân yaralanmaları olarak önemli oranda görüldü; kurşun, ahşap parça ve metal parça yaralanmaları açık hava yaralanmaları olarak görüldü (p<0,001). Dış mekân yaralanmalarında enfeksiyon oranı anlamlı olarak daha yüksekti (p: 0,006). Açık hava yaralanmalarında yaş (p: 0,005), ameliyat süresi (p: 0,007) ve kesi uzunluğu (p: 0,019) anlamlı olarak daha yüksekti. İç mekân yaralanmaları 18 yaş altında anlamlı derecede yüksekti (p:0,036). Üst ekstremite yaralanması ile yaş (r: 0,358, p <0,001) ve üst ekstremite yaralanması ile erkek cinsiyet (r: 0,241, p: 0,003) arasında anlamlı bir ilişki vardı.

Sonuç: Yabancı cisim yaralanmaları geniş yaş aralığında sık görülen yaralanmalardır. Birinci basamak olarak antibiyotik profilaksisi ve tetanos aşısı uygulanmalıdır. Ateşli silah yaralanmaları, tahta parça yaralanmaları ve kırsal çevre yaralanmaları enfeksiyonla ilişkili bulunduğundan, bu olgularda antibiyotik profilaksisinin uzatılmasının tartışıldığı ileri çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: *Yabancı Cisim, Ekstremite, Enfeksiyon, Çıkarım, Yaralanma*

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INTRODUCTION

Extremity foreign body injuries are frequent in emergency and orthopedic departments. It may cause tissue damage, inflammation, infection, delayed wound healing, toxic or allergic reactions, and late injury as a result of migration. Therefore, removal is necessary in most cases. Even though any pathologic situation may not be encountered in short term, it may occur in long term (1). These injuries are usually considered as simple injuries, but sometimes conditions could be complicated. Superficial injuries could be simply taken out of tissues in a sterile fashion while deep-seated foreign bodies need deep dissection. Local anesthesia is the chosen anesthetic method for most cases, depending on the injury site, depth, and age of patients. Direct radiography is the most used imaging modality for radiopaque foreign bodies. For nonradiopaque foreign bodies, ultrasonographic imaging is used to confirm the diagnosis. Moreover, the size of a foreign body is important to identify with direct radiography.

In literature, there is a growing interest in these injuries. In this study, we aimed to find a relation to demographics, treatment methods, injury characteristics, environmental and injury conditions so that prevention methods could be more effective.

MATERIAL AND METHODS

Hospital digital archives were searched between July 2014 and March 2020 retrospectively and patients who had foreign body removal were identified. The patients with missing data were excluded. The study was approved by the Local Ethical Committee (date: 18.3.2020, no: 2020-121). Picture Archiving and Communication Systems (PACS) and hospital archive files were examined.

Preoperative radiographic views were taken in all the patients. If not radiolucent, ultrasound examination was used. Surgery was planned according to clinical examination and radiologic findings. Informed consent was obtained before surgery. After removal, soft tissues were irrigated and the wound was closed. Infected wounds were debrided and a cultural sample was taken before closure. The excision of radiopaque foreign bodies was confirmed by fluoroscopy. Prophylactic antibiotics and tetanus vaccine (rappel dose if necessary) were started in all patients. Infected patients were treated with empirical antibiotherapy (Amoxicillin/clavulanic acid) until the result of the cultural sample.

Demographic information, injury place, injured extremity with side, foreign body type and opacity, presence of infection, chosen anesthetic method, operation time, incision length were recorded. All information was analyzed statistically.

Data were expressed as mean ± standard deviation and frequency. Data distribution was analyzed with the Kolmogorov-Smirnov test. Comparison of different parameters was done using Mann-Whitney U test whereas Chi-square test or Fisher's exact test was used for categorical variables. The phi-coefficient Cramer's V is used to assess the association between two dichotomous categorical variables. The rank-biserial correlation coefficient, rrb, is used for dichotomous nominal data vs rankings (ordinal). The correlation analyses were performed to evaluate the relationship between object type causing the injury, place of injury, age, and localization of the injury. The SPSS version of 22.0 for Windows software was used for analyses (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). A two-tailed p-value <0.05 was considered statistically significant.

RESULTS

A total of 146 patients were included. The mean age of the patients was 25.9 ± 17.99 (2-78). According to gender and side examination, 90 patients (61%) were male and 56 patients (39%) were female; 79 injuries were left (54%) and 67 were right (46%) sided. There were injuries in 68 upper extremities (46%) and 78 lower (54%) extremities. When foreign body types were examined, 5 types of foreign bodies were found: Needle (48), glass (25), wooden pieces (17), metal pieces (24), bullets&pellets (32). The vast majority of the chosen anesthetic method was local anesthesia (137, 93.8%). Other applied methods were sedation (7 patients), spinal anesthesia (1 patient), and general anesthesia (1 patient). The mean operation duration was 17.51 ± 10.18 (range 10-60) and the mean incision length was 1.32 ± 0.66 mm (range 1-5).

Statistical analysis was made between object types, results were brought into a table (table 1) and analyzed. Analysis showed a significant relationship with gender

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(p: 0.001); metallic object and bullet injuries were mostly seen in males and needle injuries were mostly seen in females. Injuries caused by metallic objects were significantly more common (p: 0.001) in the upper extremity and the vast majority of upper extremity injuries (p: 0.035). were located distal to the wrist (Figure 1). Bullet and needle injuries were significantly (p:0.001) higher in lower extremities (Figure 1). In lower extremity injuries, glass and needle injuries were mostly seen in the distal part of the ankle (Figure 2), however, bullet injuries were mostly seen in the proximal part of the ankle (p<0.001). Glass and needle injuries were seen significantly as indoor injuries; as well as the bullet, wooden part, and metallic part injuries were seen as outdoor injuries (p<0.001). Infection rates were significantly higher in bullet pellet and wooden part injuries (p: 0.009). Operation duration (p: 0.003) and incision length (p:0.001) were significantly longer in bullet injuries. There was no significant difference between object types and the applied anesthetic method (p: 0.314). Four patients with bullet injuries were operated on under sedation, 1 patient under general anesthesia, and 1 patient (3.1%) under spinal anesthesia. 2 patients with needle injury and 1 patient with metal piece injury were operated on under sedation.

Figure 1.
A. 32-year-old patient with foreign body in left proximal interphalangeal joint
B. 13-year-old patient with left foot needle injury. Needle was successfully removed and patient was healed without any complication

Figure 2. 10-year-old patient with glass in left foot. Glass piece was removed under local anesthesia and patient was discharged in the same day.

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Statistical analysis was applied according to injury place and results were brought into a table (table 2). The male gender was significantly higher in outside injuries. Although there was no significant difference between upper and lower extremity injuries, it was observed that injuries distal to the ankle were frequently indoor injuries (p<0.001). The infection rate was significantly higher in outdoor injuries (p: 0.006). Age (p: 0.005), operation time (p: 0.007) and incision length (p: 0.019) were significantly higher in outdoor injuries. No significant relationship was found between injury place and anesthesia method (p:0.149).

Patients were divided into 3 groups according to age as under 18, between 18-65 and over 65, were analyzed and brought into a table (table 3). There were 66 patients (45.2%) under 18, 72 patients (49.3%) between 18-65, and 8 patients (5.4%) older than 65 years of age. Wooden part injuries were significantly higher in patients over 65 years of age (p <0.001).

Upper extremity injuries were significantly more common in patients aged 18 years and older (p <0.001) and lower extremity injuries were significantly more common under 18 years of age (p <0.001). Injuries with radiopaque objects were significantly higher in patients under 18 years of age (p: 0.001). Indoor injuries were significantly frequent under 18 years of age (p:0.036).

There was no significant relationship between anesthesia method and age (p: 0.817) and extremities (p:0.435). General anesthesia was performed in 1 patient and sedation was performed in 4 patients under the age of 18. Spinal anesthesia was performed in 1 patient and sedation was performed in 3 patients between 18-65 ages.

There was a significant correlation between upper extremity injury and age (r: 0.358, p <0.001) and weak correlation between upper extremity injury and male gender (ϕ = 0.241). Operation duration was found significantly correlated with incision length (r: 0.458, p<0.001) and bullet&pellet injuries (r: 0.281, p: 0.001) but no correlation was found with radiopacity (r: -0.044, p:0.602), age (r: 0.018, p:0.826), extremities (r:0.045, p:0.591), infection presence (r:0.087, p:0.295). Infection presence was found significantly correlated with incision length (r:0.285, p<0.001) and weakly correlated with wooden piece injuries (ϕ =0.237) but no correlation was found with male gender (ϕ =0.166), bullet &pellet injuries (ϕ =0.141, p:0.091). Incision length was also significantly correlated with bullet injury (r:0.294, p<0.001). A weak correlation was found between metal piece injuries and upper extremities (ϕ =0.298) as well as between needle injuries and lower extremities (ϕ =0.227). The male gender was not significantly correlated with metal piece injuries (ϕ =0.18) and bullet&pellet injuries (ϕ =0.186), also female gender was moderately correlated with needle injuries (ϕ =0.323). Age was also significantly correlated with wooden piece injuries (r: 0.177, p:0.033).

In the binary logistic regression analyses, upper extremity injury was independently associated with the male gender (table 4). Upper extremity injury was also independently associated with metal piece injury.

DISCUSSION

Foreign body-related extremity injuries are common injuries in a wide age range. We had 146 patients included in this study, fewer patients than most studies; although all of them were done in tertiary healthcare centers this study was done in a secondary healthcare center. Age range (2-78) and mean age (25.9 ± 17.99) in this study was found similar to current literature (2-5). Under the age of 18, the lower extremity (75.8%) was the most common injury site and most of the injuries were indoor injuries (p: 0.036). These results were caused by the fact that children and young people under the age of 18 spend more time at home as literature corroborated (3). A previous study revealed that, under the age of 18, the needle was the most common injury object (67.4% in men and 94.2% in women) (3). Another previous study revealed that needle was the most common injury cause (29%) under the age of 13 (6). Although both studies verified needle was the most common injuring object under the age of 18; we believe this study revealed a more accurate result. Because both studies were from tertiary healthcare centers with the heterogenic patient group sent from other hospitals and this study was from a state hospital of a small district (pop.:80447) and had more homogenous patient group.

In our study, the most injuring object was needle (48; 32.4%) which is compatible with literature; despite different percentages (2,3,7). Object types differ as a result of social situations. The district where this study

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was conducted is a settlement with predominant rural life. Metal piece injuries were seen mostly in males and needle injuries were seen mostly in females; because the majority of men work in industrial labor works and the majority of women do housework at home. Bullet&pellet injuries were seen mostly in males in lower extremities; because men hunt more like a rural life activity and consequently injure themselves as an accident. This also explains the reason metallic object and bullet injuries occur outdoor and needle injuries indoor as well as male gender association with outdoor and upper extremity injuries. These results were compatible with the literature although bullet&pellet injuries were excluded in other studies (3).

Infection is a major complication of foreign body injuries. It has been reported in the literature that soft tissue infections can lead to serious conditions such as osteomyelitis and septic arthritis, and successful results have been obtained with foreign body removal, debridement, and antibiotherapy in treatment (1, 8-10). These infections may be asymptomatic in the acute period and may occur in the late period as 8-20 years (1, 10). In this study, no patient was presenting at such a late stage. The presence of infection was associated with bullet and wood piece injuries; bullet&pellet injuries were associated with severe soft tissue damage and contamination as stated in literature (11-13). Patients with accompanying bony injuries were excluded from the study; tetanus and antibiotic prophylaxis were immediately applied to all patients admitted with foreign body injury. These were the main reasons for the lower infection rate (4%) compared to literature (8.5-9%) (13, 14). Wood pieces were also associated with infection presence; the most probable explanation is that these were generally farmyard injuries with high contamination risk. Also, difficulty to access primary care services where the injury occurred, and ignoration of injuries contributed to this. It is interpreted that the relationship between infection and outdoor injuries to fact that both bullet and wood fragment injuries occur outdoor and outdoor injuries carry a higher risk of contamination. The correlation between incision length and infection is suggested due to wider incisions made for debridement in presence of infection.

There was no significant relationship between injury place and extremity; however, it was observed that ankle injuries and distal were mostly indoor. Glass and needle injuries were also significantly more common than indoor injuries. Therefore, it is found reasonable that the mechanism behind is to step on these two common objects at home with bare feet.

Clinical examination and radiological evaluation are important in the diagnosis of foreign body injuries. Evidence of local infection and foreign body reaction can be seen in clinical evaluation (4). Especially in children, it may be overlooked or hard to realize; therefore, foreign body injury should be suspected in presence of allergic reaction, inflammation, and local infection. Radiological evidence usually supports the diagnosis. Glass pieces larger than 2 mm., metal, some plastic, and wooden pieces can be viewed with AP and lateral radiography (15). Ultrasonography and computed tomography are successful methods in cases where the object cannot be visualized by radiography (16, 17).

Due to the insufficient number of studies on the treatment of foreign body injuries, there is no standard treatment algorithm (7). Prophylactic tetanus vaccination and antibiotherapy should be administered in the emergency room immediately. Although removal is performed in all foreign body injuries which are easy to access, conservative treatment should be preferred in foreign body injuries that penetrate deep tissues without causing an infection, due to the risk of serious complications such as neurovascular injury (4). Removal can be performed under local anesthesia in emergency departments, but operation room conditions are mandatory to avoid iatrogenic infection. We recommend this procedure to be performed in the operation room, for benefit of the C-arm scope and avoidance of serious complications.

There is no definite way of prevention from foreign body injuries. Protection methods may vary according to age as well as characteristics of the environment and society. Proper protective gear is the primary method of prevention from these injuries at heavy labor workplaces. Parents should be instructed of such injuries to prevent kids from this kind of injuries.

There were some strengths and limitations of this study. This study was retrospective so that, it had inferior level of evidence compared with prospective

studies. There were only 6 years of hospital data therefore 146 patients were included which means fewer patients comparing other studies in literature (2, 3, 5) . Consequently, a multicenter study with a large number of patients with a longer follow-up period is needed for a common injury like this to achieve more accurate results. There were data of different doctors, with no common work time, which makes the data less reliable. The hospital where this study was done is in a rural state, thus patient population was more homogenous than tertiary centers.

CONCLUSION

Foreign body injuries are common injuries seen in a wide age range. Serious complications may occur if not intervened appropriately, and clinical picture may emerge even years after injury. Although local anesthetic methods are often sufficient, general anesthetic methods may be required especially for kids and deep-seated foreign body injuries. Antibiotic prophylaxis and tetanus vaccine should be applied as primary care. Since firearm injuries, wooden part injuries and injuries in the rural environment are found to be associated with infection, further studies are needed to discuss to extend the duration of antibiotic prophylaxis in these cases.Local anesthetics are usually sufficient, however general anesthesia may be required for pediatric cases, and deep seated injuries.Firearm and farmyard injuries are associated with infection. Infection requires longer incision, due to the need of appropriate surgical debridement.A multicenter study with a large number of patients with a longer follow-up period is needed for a common injury like this to achieve more accurate results.

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