ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

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Bir Üniversite Hastanesi Acil Servisine Kas iskelet Travması Nedeniyle Başvuran Pediatrik Hastaların Değerlendirilmesi

Evaluation of Emergency Unit Admissions of Pediatric Patients with Musculoskeletal Trauma to a University Hospital

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ÖZ

Giriş: Pediatrik travmaya bağlı yaralanmaların özelliklerinin tanımlanması, özelleşmiş bakım için önemlidir. Bu çalışmada, pediatrik yaş gruplarında kas-iskelet sistemine herhangi bir travmatik yaralanma nedeniyle acil servise yapılan başvuru sıklığını, özelliklerini ve ilişkili faktörleri belirlemeyi amaçladık.

Yöntem: Veriler acil servis kayıtlarımızdan pediatrik travma ziyaretlerine dair retrospektif bir inceleme yapılarak toplanmıştır. Analiz edilen veriler, demografik özellikler, hastaneye kabul zamanları, travma etiyolojileri, travma bölgesi (üst-alt ekstremite), yaralanma türlerinin oranları ve sayılarını içermektedir.

Bulgular: Ocak 2019-Aralık 2020 tarihleri arasında bir üniversite hastanesinde kas-iskelet sistemi travması nedeniyle çocuk acil servisine başvuran toplam 2627 hasta değerlendirilmiştir. Tüm yaş grupları arasında en yüksek başvuru oranı 16-20 yaş arasındaydı. En sık etyoloji, tüm yaş gruplarında aynı seviyeden düşme idi. Üst ekstremite yaralanmalı hasta sayısı (n=2110), alt ekstremite yaralanmalı hasta sayısından (n=517) daha fazlaydı. Bu yaralanmalar nedeniyle değerlendirilen çocukların %90,7'si (2382) konservatif olarak tedavi edilmiştir. Travma nedeniyle en fazla başvuru Temmuz, Eylül ve Ağustos aylarında görülmüştür.

Sonuç: Bu tek merkezli çalışma, klinisyenlerin pediatrik popülasyondaki kas-iskelet sistemi yaralanma paternleri ve özellikleri ile birlikte bu yarlanmalarla ilgili faktörleri belirlemelerine yardımcı olacaktır.

Anahtar Kelimeler: pediatri, kas iskelet, travma, acil

ABSTRACT

Objective: Defining the characteristics of pediatric trauma injuries is essential for providing specialized care. We aimed to clarify and determine the frequency of admission to the emergency department due to any traumatic injury to the musculoskeletal system, its characteristics, and related factors in pediatric age groups.

Method: We reviewed data through a retrospective analysis of pediatric trauma visits from our emergency unit records. Data analyzed included demographic properties, hospital admission hours, trauma etiologies, trauma site (upper-lower extremity), and the rates and numbers of injury types.

Results: A total of 2,627 patients admitting to the pediatric emergency unit due to musculoskeletal trauma in a university hospital from January 2019 to December 2020 were evaluated. The highest rate of admission was in the 16-20 years among all age groups. The most common etiology was a fall from the same level in all age groups. The number of patients with upper extremity injury (n = 2110) was higher than those with lower extremity injury (n = 517). Ninety percent (2382) of the children evaluated for these injuries were treated conservatively. The highest number of admissions due to trauma was observed in July, September, and August.

Conclusion: This single-center study will help clinicians determine musculoskeletal injury patterns in the pediatric population, along with their characteristics and related factors in pediatric age groups.

Keywords: pediatrics, muscuoskeletal, trauma, emergency,

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INTRODUCTION

Traumatic musculoskeletal injuries account for a high proportion of admissions to pediatric emergency departments. (1) In addition to being a significant cause of death in the pediatric population, traumatic injuries can result in lifelong disability and impaired quality of life requiring hospital care. (2,3)

Many studies focus only on fractures or dislocations of a specific body region or group of patients in the Pediatric population. (4-7) Lacerations, sprains and puncture wounds are other common patterns of injury requiring hospital care. To our knowledge, accurate epidemiological classification of musculoskeletal injuries in children based on age groups and injury mechanisms is limited.

Assessing and understanding the characteristics of traumatic musculoskeletal injuries in the pediatric population is essential to facilitate effective triage and to develop effective prevention strategies.

The aim of our study was to determine the frequency of emergency department (ED) admissions for musculoskeletal trauma, its characteristics and associated factors in pediatric age groups.

MATERIALS AND METHODS

Following Institutional Review Board approval, a retrospective analysis was performed for patients who admitted to the pediatric emergency department for musculoskeletal trauma at a university hospital between January 1, 2019 and December 31,2020.

Patients admitted to the Orthopaedic Emergency Department were catagorized according to age group (0-2 years, 3-6 years, 7-11 years, 12-17 years, 0-17 years), gender, admission time (00:00-08:00/08:00-12:00/12:00-16:00/16:00-20:00/20: 00-00:00), trauma aetiology, trauma site (upper-lower extremity), rates and numbers of injury types (fracture, dislocation, fracture-dislocation, laceration, foreign body), and amputation rates.Data were retrieved from the digital hospital records.

Patients with head, abdominal and chest trauma or with multiple fractures were excluded from the study. Statistical analysis was carried out by using SPSS, v.22.0 software (SPSS Inc., Chicago, Illınois,USA) Results were presented as nominal / categorical variables.

RESULTS

A total of 2627 pediatric trauma patients were treated during the study period. Of these were 1739 males, 888 females. The distribution of demographic characteristics of trauma patients by age group was presented in Table 1. The highest rate of admission was between 16- 20 among all age groups. The most common etiology was fall from the same level in all age groups. The number of patients with upper extremity injury (n =2110) was higher than those with lower extremity injury (n=517).

The distribution of fracture regions, dislocation, fracture-dislocation, and soft tisse injuries such as laceration and foreign body patients admitted to the emergency department by age groups is shown in Table 2,3 and 4 respectively.

90.7 % of the children evaluated for these injuries were treated conservatively and discharged, 8.4 % were treated surgically. The remaining 0.9% prentally refused the offered treatment.

The highest number of admissions due to trauma was observed in July, September, and August whereas the lowest number of entries were in April, December, and January (Table 6)

Table 1. Distribution of Patients According to Age, Trauma Time ,Etiology and Trauma Region

	0-2 age	3-6 age	7-11 age	12-17 age	Total
Sex					
Male	154 (44.8%)	414 (58.9%)	514 (67.3%)	657 (80.5%)	1739 (66.2%)
Female	190 (55.2%)	289 (41.1%)	250 (32.7%)	159 (19.5%)	888 (33.8%)
Trauma time					
00:00-08:00	48 (14%)	100 (14.2%)	70 (9.2%)	102 (12.5%)	320 (11.4%)
08:00-12:00	30 (8.7%)	65 (9.2%)	75 (9.8%)	84 (10.3%)	254 (9.7%)
12:00-16:00	67 (19.5%)	155 (22%)	153 (20%)	193 (23.7%)	568 (21.6%)
16:00-20:00	102 (29.7%)	205 (29.2%)	270 (35.3%)	247 (30.3%)	824 (31.4%)
20:00-00:00	97 (28.2%)	178 (25.3%)	196 (25.7%)	190 (23.3%)	661 (25.2%)
The etiology of Trauma					
Traffic accident	3 (0.9%)	32 (4.6%)	26 (3.4%)	45 (5.5%)	106 (4%)
Stab injury	9 (2.6%)	26 (3.7%)	31 (4.1%)	54 (6.6%)	120 (4.6%)
Injury with glass	9 (2.6%)	25 (3.6%)	21 (2.7%)	36 (4.4%)	91 (3.5%)
Crush injury	20 (5.8%)	30 (4.3%)	20 (2.6%)	22 (2.7%)	92 (3.5%)
Falls on the same level	285 (82.8%)	540 (76.8%)	604 (79%)	495 (60.7%)	1924 (73.2%)
Falls from height	5 (1.5%)	19 (2.7%)	11 (1.4%)	14 (1.7%)	49 (1.9%)
Sprain	5 (1.5%)	10 (1.4%)	18 (2.4%)	47 (5.8%)	80 (3%)
Punch injury	1 (0.3%)	-	7 (0.9%)	65 (8%)	73 (2.8%)
Assault	-	-	-	4 (0.5%)	4 (0.2%)
Injuries from falling object	5 (1.5%)	19 (2.7%)	18 (2.4%)	11 (1.3%)	53 (2%)
Sports injury	1 (0.3%)	1 (0.1%)	6 (0.8%)	19 (2.3%)	27 (1%)
Industrial injury	1 (0.3%)	2 (0.2%)	1 (0.1%)	4 (0.4%)	8 (0.3%)
Trauma region					
Upper extremity	276 (80.2%)	577 (82.1%)	617 (80.4%)	640 (78.4%)	2110(80.3%)
Lower extremity	68 (19.8%)	126 (17.9%)	147 (19.6%)	176 (19.5%)	517(19.7%)

Table 2. Distribution of Fracture Sites by Age Groups

	0-2 age	3-6 age	7-11 age	12-17 age	Total
Upper extremity fractures	**n=161**	**n=445**	**n=579**	**n=527**	**n=1712**
Scapula fracture	0 (0%)	1 (0.2%)	1 (0.2%)	1 (0.1%)	3 (0.2%)
Clavicula fracture	34 (21.1%)	85 (19.1%)	34 (5.9%)	37 (7%)	190 (11.1%)
Proximal humerus fracture	8 (4.9%)	19 (4.3%)	15 (2.6%)	8 (1.5%)	50 (2.9%)
Humerus shaft fracture	1 (0.6%)	0 (0%)	6 (1%)	5 (0.9 %)	12 (0.7)
Distal humerus fracture	39 (24.2%)	107 (24%)	63 (10.9%)	14 (2.7%)	223 (13%)
Radius head fracture	2 (1.2%)	14 (3.1%)	12 (2.1%)	7 (1.3%)	35 (2%)
Olecranon fracture	1 (0.6%)	4 (0.8%)	4 (0.7%)	4 (0.8%)	13 (0.8%)
Radius shaft fracture	1 (0.6%)	8 (1.6%)	20 (3.5%)	9 (1.7%)	38 (2.2%)
Ulna shaft fracture	2 (1.2%)	8 (1.6%)	9 (1.6%)	5 (0.9%)	24 (1.4%)
Forearm fracture	19 (11.8%)	70 (10%)	100 (17.3%)	49 (9.3%)	238 (13.9%)
Distal radius fracture	50 (31.1%)	96 (15.7%)	246 (42.5%)	191 (36.2%)	583 (34.1%)
Distal ulna fracture	0 (0%)	0 (0%)	1 (0.2%)	5(0.9%)	6 (0.4%)
Scaphoid fracture	0 (0%)	0 (0%)	0 (0%)	9 (1.7%)	9 (0.5%)
Hamatum fracture	0 (0%)	0 (0%)	0 (0%)	1 (0.1%)	1 (0.06%)
Other carpal bone fracture	0 (0%)	0 (0%)	0 (0%)	1 (0.1%)	1 (0.06%)
Metacarpal fracture	1 (0.6%)	2 (0.4%)	16 (2.8%)	92 (17.5%)	111 (6.5%)
Phalangeal fracture	3 (1.8%)	31 (7%)	52 (9%)	89 (16.9%)	175 (10.2%)
Lower extremity Fractures	**n=44**	**n=89**	**n=113**	**n=184**	**n=430**
Pelvis fracture	0 (0%)	3 (3.4%)	1 (0.9%)	8 (4.3%)	12 (2.8%)
Asetabulum fracture	0 (0%)	0 (0%)	0 (0%)	2 (1.1%)	2 (0.5%)
Proximal femur fracture	0 (0%)	2 (2.2%)	3 (2.7%)	2 (1.1%)	7 (1.6%)
Femur shaft fracture	11 (25%)	14 (15.7%)	19 (16.8%)	13 (7.1%)	57 (13.3%)
Distal femur fracture	3 (6.8%)	0 (0%)	8 (7.1%)	21 (11.4%)	32 (7.4%)
Patella fracture	2 (4.5%)	1 (1.1%)	2 (1.8%)	1 (0.5%)	6 (1.4%)
Proximal tibia fracture	0 (0%)	2 (2.2%)	3 (2.7%)	2 (1.1%)	7 (1.6%)
Tibia shaft fracture	12 (27%)	31 (34.8%)	19 (16.8%)	13 (7.1%)	75 (17.4%)
Distal tibia fracture	9 (20.5%)	16 (18%)	8 (7.1%)	21 (11.4%)	54 (12.6%)
Fibula shaft fracture	0 (0%)	1 (1.1%)	0 (0%)	3 (1.6%)	4 (0.9%)
Malleolus fracture	2 (4.5%)	1 (1.1%)	11 (9.7%)	28 (15.2%)	42 (9.8%)
Calcaneus fracture	0 (0%)	0 (0%)	1 (0.9%)	4 (2.2%)	5 (1.2%)
Navicular fracture	0 (0%)	0 (0%)	0 (0%)	3 (1.6%)	3 (0.7%)
Metatarsal fracture	3 (6.8%)	14 (15.7%)	13 (11.5%)	19 (10.3%)	49 (11.4%)
Phalangeal fracture	2 (4.5%)	4 (4.4%)	25 (22.1%)	44 (23.9%)	75 (17.4%)

Table 3. Distribution of Joint Dislocation İnjuries by All Age Groups.

	0-2 age	3-6 age	7-11 age	12-17 age	Total
Upper extremity joint dislocation					
Acromioclavicular dislocation	-	-	-	1 (5.6%)	1 (0.4%)
Shoulder dislocation	-	-	-	6 (33.3%)	6 (2.7%)
Elbow dislocation	-	2 (2%)	2 (28.6%)	-	4 (1.8%)
Pulled elbow	103 (100%)	95 (96.9%)	-	-	198 (87.8%)
MCP joint dislocation	-	-	2 (28.6%)	1 (5.6%)	3 (1.3%)
PIP joint dislocation	-	-	1 (14.2%)	2 (11%)	3 (1.3%)
Lower extremity joint dislocation					
Patella dislocation	-	-	-	5 (27.7%)	5 (2.2%)
PİP joint dislocation	-	-	-	1 (5.6%)	1 (0.4%)
Fracture dislocation					
Elbow fracture dislocation	-	-	-	1 (5.6%)	1 (0.4%)
Montegia fracture dislocation	-	1 (1.1%)	2 (28.6%)	-	3 (1.3%)
CMC fracture dislocation	-	-	-	1 (5.6%)	1 (0.4%)

Table.4 Distribution of Soft Tissue İnjuries by All Age Groups					
	0-2 age	**3-6 age**	**7-11 age**	**12-17 age**	**Total**
Upper extremity injury					
Upper limb laceration	20 (66.6%)	42 (82.4%)	43 (93.5%)	48 (94.1%)	153 (86%)
Finger tip amputation	10 (33.4%)	7 (13.7%)	3 (6.5%)	3 (5.9%)	23 (12.9%)
Foreign body	-	2 (3.9%)	-	-	2 (1.1%)
Lower extremity injury					
Lower limb laceration	5 (83.3%)	19 (95%)	15 (78.9%)	35(97.2%)	74 (91.4%)
Foreign body	1 (16.7%)	1 (5%)	4 (21.9%)	1 (2.8%)	7 (8.6%)

Table 5. Distribution of Tratment Modalities by All Age Groups					
	0-2 age	**3-6 age**	**7-11 age**	**12-17 age**	**Total**
Treatment modalities					
Conservative	319 (92.7%)	638 (90.7%)	699 (91.5%)	726 (89%)	2382 (90.7%)
Surgical	24 (7%)	60 (8.5%)	58 (7.6%)	80 (9.8%)	222 (8.4%)
Refusing treatment	1 (0.3%)	5 (0.7%)	7 (0.9%)	10 (1.2%)	23(0.9%)

Table 6. Distribution of Admissions According to Months In All Age Groups					
	0-2 age	**3-6 age**	**7-11 age**	**12-17 age**	**total**
January	24 (7%)	47 (6.7%)	44 (5.8%)	74 (9.1%)	189 (7.2%)
February	28 (8.1%)	46 (6.5%)	36 (4.7%)	63 (7.7%)	173 (6.6%)
March	21 (6.1%)	49 (7%)	58 (7.6%)	67 (8.2%)	195 (7.4%)
April	8 (2.3%)	31 (4.5%)	38 (5%)	45 (5.5%)	122 (4.6%)
May	12 (3.4%)	60 (8.5%)	57 (7.5%)	61 (7.5%)	190 (7.3%)
June	19 (5.6%)	70 (10%)	79 (10.3%)	71 (8.7%)	239 (9.1%)
July	40 (11.7%)	81 (11.5%)	102 (13.4%)	84 (10.3%)	307 (11.7%)
August	33 (9.6%)	83 (11.8%)	91 (11.9%)	66 (8.1%)	273 (10.4%)
September	44 (12.7%)	74 (10.5%)	87 (11.4%)	91 (11.2%)	296 (11.3%)
October	41 (11.9%)	60 (8.6%)	66 (8.6%)	70 (8.6%)	237 (9%)
November	41 (11.9%)	56 (7.9%)	65 (8.5%)	59 (7.3%)	221 (8.4%)
December	33 (9.6%)	46 (6.5%)	41 (5.4%)	65 (8%)	185 (7.1%)

DISCUSSION

This study examines the characteristics of emergency unit admissions for musculoskeletal trauma in a tertiary referral center and presents epidemiological data for the period. Most studies in the literature focus on either fracture epidemiology or childhood trauma in a multidisciplinary approach.(8-9) However, there are limited studies investigating the epidemiological data of musculoskeletal injuries in the Turkish pediatric population.(10) The data obtained from this study may assist clinicians in identifying musculoskeletal injury characteristics in the Turkish pediatric population and developing effective prevention and treatment strategies.

Numerous studies report that falling injuries and motor vehicle accidents are the most common modes of trauma for childhood injuries. Previous research reports that falls account for 38% of injuries in the pediatric population.(11) In another study, Akay et al. found that road traffic accidents (RTAs) were the most common causes of injury (49%), followed by falls (31%).(12)

In a prospective cohort study of pediatric trauma admissions across multiple centres, road traffic accidents (RTAs) and falls were the two most common injury patterns, accounting for 41% each.(13) The study found that most RTAs occurred in low-income countries, while most falls occurred in high-income countries. The researchers suggested that the quality of infrastructure and traffic load could be the cause of this difference. (13)

In our study, falling was the primary cause of injuries among our

population. Falls from the same level were significantly more frequent than any other injury pattern across all age groups. Unlike previous studies, we did not observe common injury patterns such as traffic accidents or sports injuries frequently in our study group. This is mainly due to the impact of COVID-19 lockdown across the country. Due to the lockdown, people have been spending more time at home and avoiding the use of vehicles. This has resulted in a reduction in traffic and the risk of RTAs.

Consistent with published data, upper extremities were more commonly involved than lower extremities. Several studies have reported the most common injury site in childhood trauma as the upper extremity (14-16). Our results support these findings, with lower extremity fractures accounting for 37.8% of cases. This may be due to the fact that these injuries often occur in-home or on playgrounds at ground level. The upper extremity, wrist, and elbow are the most vulnerable parts of the body, primarily due to falls on outstretched hands. Lower extremity traumas could have been prevented with a relatively low rate of road accidents or sports injuries.

Previous studies have demonstrated that boys have higher injury rates than girls (14,17). The present study confirms this finding, showing that boys are twice as likely to sustain injuries as girls. Furthermore, the study found that male dominance in injuries steadily increases with age. These results are consistent with those reported by other authors for the pediatric population, with a maximum ratio of 3:1. This difference may be attributed to the fact that males tend to be more physically active than their female peers. Various authors have reported gender-based disparities in physical activity during adolescence (18,19).

Distal radius fractures are the most common type of fracture, accounting for 27% of all fractures. This is consistent with previous studies which report that distal radius fractures make up 20-35% of all pediatric fractures.(20,21) Our data supports this finding. It is estimated that infants and young children are most likely to experience distal fractures of the hand. (22) Interestingly, the number of distal bone fractures in the upper extremity, such as metacarpal and phalanges, increased with age inconsistently. This may be due to the injury patterns observed in our population. Distal phalanx fractures are typically associated with crush injuries in the pediatric population aged 0-4 years. However, in our study group, crush injuries were significantly less common than other injury mechanisms, which may explain the relatively low rate of distal bone fractures.

Common upper extremity injuries, other than fractures, include upper limb lacerations, fingertip amputations, and foreign bodies. In our study, these injuries have been reported in all age groups. However, rates of fingertip amputations peak at 0-2 years and decrease with age, while rates of upper limb lacerations increase with age, with a rise between ages 12-17. At an early age, children are naturally curious and tend to explore their environment without making rational decisions, which puts them at risk of crush injuries and fingertip amputations. As they grow and develop fine motor skills, they become more aware and less prone to fingertip injuries, but are still vulnerable to lacerations due to their increasing activity levels. (23)

Of the lower extremity fractures, the tibia is the most common site for fractures, followed by phalanges and femur. Most tibia and femur fractures were observed in children under six years old, while the children above six years old suffered mostly from phalangeal fractures. This can be explained by the increased participation in recreational or contact sports activities in the population above six years old, as most phalangeal fractures require a direct kick to an object or a forced angulation. (24)

Skin lacerations and foreign bodies were the two common injury patterns other than fractures involving the lower extremity. Minor lacerations can be considered as proof of children's unawareness about their environment in all age subgroups. Although these injuries are unlikely to be life-threatening, they mostly need hospital care to prevent further infection and wound closure problems.(25)

Most patients in the study were treated conservatively with clinical and radiological follow-ups. This is mostly due to the high remodeling capacity of the pediatric population. This data is consistent with previous studies encouraging conservative treatment methods in children. (26,27) Rapid healing and high remodeling capacity can be considered the main advantage in treating traumatic injuries in children. However, the number of cases that require surgical treatment should not be underestimated.

In the study group, 220 injuries required surgery. The most common surgical indication was distal humeral fractures, which include medial epicondyle, lateral epicondyle, and supracondylar humerus fractures. Hand lacerations, femur shaft fractures, and fingertip amputations followed in frequency. Previous studies have shown that humerus and femur fractures were the most common injuries requiring hospitalization. (28) Out of 223 distal humerus fractures in our study group, 83 were treated surgically, accounting for 37.6% of all surgical interventions. The relatively low rate of femoral fractures during the COVID lockdown can be attributed to reduced mobility. The lockdown may have decreased the risk of high-energy trauma, such as traffic accidents or contact sports.

A high proportion of patients were admitted to emergenceny department in July, August and September. The high peak of admissions during the summer season is mainly due to increased outdoor leisure activities by children in the warm weather. In addition, an increased number of motorcycles and bicycles could lead to serious road accidents in the summer season. Several studies have investigated the seasonal effect on trauma admissions and reported a positive correlation (between fractures) and mean monthly sunshine hours, which is consistent with our findings. (29,30)

The current study has a number of limitations. The dataset is from a single hospital emergency department and may not reflect the whole population during a limited period of time. Another limitation is that the study relies on retrospectively collected data, which means that some risk factors may not have been recorded, and the study covers the period of the COVID pandemic. The studies report a decrease in the number of acute trauma referrals, admissions and operations during the lockdown period, suggesting a reduction in trauma-related healthcare utilisation.(31,32) This may be due to a number of factors, including reduced attendance due to patients' perception of risk, the impact of lockdown messages, and reduced social mobility. This reduction may have influenced our results.

CONCLUSION

Musculoskeletal injury patterns representing an emergency unit may vary in children. Depending on the age and the social environment, they are exposed to different kinds of trauma. Most trauma to the musculoskeletal system occurs by falling on the same level and involves bone fractures. However, other injuries such as lacerations or dislocations also need urgent medical care to prevent critical functional problems.

The data obtained through such epidemiologic studies will also help clinicians determine the musculoskeletal injury patterns in the pediatric population; this will guide them to understand these injuries better and develop effective triage and treatment strategies to manage those injuries.

Ethics Committee Approval: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study conformed to the provisions of the Declaration of Helsinki (as revised in 2013). This retrospective study was approved by the Institutional Review Board (Marmara University Ethic commite: 09.2021.153) and the informed consents were waived by approval of Institutional Review Board.

Author Contributions: All authors contributed to the manuscript.

(I) Concept: Y Agirdil,Ö Baysal (II) Design: All authors ; (III) Supervision: Y Agirdil, O Baysal, E Sanrı; (IV) Resources: Ö Baysal, E Sanrı, M Gundogdu (V) Materials: Y Ağirdil, E Sanri, Ö Baysal (VI) Data collection and/or processing:Y Agirdil, M Gundogdu, B Gunar; (VII) Analysis and/or interpretation: Y Agirdil ,M Gundogdu, B Gunar, ; (VIII) Literature search: All authors; (IX) Writing manuscript and critical review: All authors.

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