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Auricular Hematoma in Athletes: Treatment and Risks of Neglect

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Abstract

Introduction: Auricular hematoma is most often caused by direct blunt trauma to the outer ear and is frequently seen in individuals who engage in full-contact sports such as boxing, wrestling, and rugby. This condition occurs when blood accumulates between the cartilage and skin, resulting in pressure that compresses the perichondrium, leading to ischemia. If untreated, it can cause infections, perichondritis, necrosis, and permanent deformity, commonly referred to as "cauliflower ear". Standard treatment includes hematoma evacuation and the application of pressure dressings or sutures. However, alternative methods and modifications of standard approaches are currently under investigation.

Aim of the Study: The aim of this study is to evaluate the current understanding of auricular hematoma and cauliflower ear in athletes, with an emphasis on new treatment approaches, prevention and the potential complications associated with untreated cases.

Materials and Methods: A review of research literature was conducted through databases such as PubMed, Google Scholar, ResearchGate, and the Cochrane Library.

Conclusion: Auricular hematoma is a prevalent injury in contact sports, requiring prompt and effective treatment to prevent complications. New evidence indicates that untreated auricular hematoma may lead to complications such as hearing loss and infections. Recent advancements in drainage techniques, surgical approaches, and non-invasive approaches offer

promising management options. However, current research is limited by small sample sizes, underscoring the need for larger clinical trials and long-term studies.

Keywords: auricular hematoma, cauliflower ear, wrestler's ear, otohematoma, auricular hematoma complications and recurrent auricular hematoma.

Introduction

Combat sports are characterized by frequent direct interactions between athletes. These inherent aspects put participants at significant risk of various injuries, which may affect the head and face regions. (1) Although there are few studies examining the epidemiology of auricular haematoma in athletes, the available research highlights its significant prevalence. A survey of over 500 U.S. college wrestlers found that 52% of those who did not use protective headgear developed auricular hematoma at least once. (2) Another study reports that among 55 Finnish male athletes, including 31 wrestlers and 24 judokas, the prevalence of cauliflower ear was 84%. (3) A different report analyzed a large cohort of 1,632 elite judo athletes worldwide. Ear deformities were identified in 55.5% of the judokas. The findings also revealed significant gender differences, with male athletes being far more frequently affected than female athletes. (4) An auricular hematoma occurs when trauma disrupts the cartilage-perichondrium connection, leading to swelling, cartilage damage, and eventual deformity known as cauliflower ear due to fibrous cartilage growth, scarring, and calcification. (5) (6) (7) Effective treatment of auricular hematoma primarily relies on prompt drainage and the application of compression to the affected area to prevent blood from reaccumulating. Neglecting proper care can result in permanent ear deformity. (8) (9) This article will focus on the pathogenesis of the condition, various methods of treating auricular hematomas, approaches for managing and prevention of recurrent cases, treatment of fully developed cauliflower ear, and a review of studies describing the consequences of untreated or improperly managed cases.

Histology and Anatomy

The ear's main anatomical structures are: helix, antihelix, concha, tragus, lobule, scaphoid fossa, triangular fossa, and antihelix crura. (10) The external ear is supplied by the posterior auricular artery (PAA), which nourishes the entire posterior surface and the concha, and the superficial temporal artery (STA), which supplies the anterior surface. Venous drainage of the external ear is variable, primarily flowing through the postauricular vein into the interconnected network of the external jugular, superficial temporal, and retromandibular veins. Sensory innervation includes the lesser occipital (C2) and greater auricular (C2, C3) nerves for general sensation, with contributions from the auriculotemporal nerve (CN V3) to the anterior rim and tragus and Arnold's nerve (CN X) to the concha and external canal. (11) The auricle is histologically made up of elastic cartilage, which is covered by a delicate perichondrium that delivers nutrients and oxygen, along with an outer layer of skin containing sebaceous and sweat glands. This cartilage provides both flexibility and structural support, with the perichondrium playing a crucial role in vascular supply since the cartilage does not have blood vessels. The lobule is composed of fibrofatty tissue and lacks cartilage .(12) Most hematomas form on the anterior ear due to the tight adhesion between the skin and perichondrium, unlike the looser posterior connection buffered by muscle and fat. (13)

Pathophysiology

An auricular hematoma occurs when trauma causes blood to pool between the cartilage and perichondrium, disrupting the normal blood supply. This separation leads to swelling and further detachment of the cartilage. The lack of nutrients causes cartilage damage, which can result in the growth of ectopic fibrous cartilage and scarring. Over time, this permanent deformity is known as cauliflower ear. (11) The exact location of traumatic auricular hematomas remains debated. One of the first experiments that explored this topic with a physiological approach was conducted using a rabbit model to simulate auricular hematomas by dropping a 10 g weight onto the right ear, using the left ear as a control. Daily macroscopic observations were made, and biopsies were taken weekly from the central region of both the treated and control ears. Histological analysis showed that hematomas were more likely to form intracartilaginously. (6) However, it is generally assumed and taught that most auricular hematomas occur between the perichondrium and cartilage. This idea originates from a study by Ohlsen et al., in which blood clots placed between the perichondrium and

cartilage resulted in the formation of new cartilage over a period of four weeks. Microscopic analysis revealed that new cartilage developed from the anterior perichondrium, not the cartilage itself, clarifying why some clinicians thought the cartilage was damaged and that the haematoma occurs intracartulagenously. The development of cauliflower ear from auricular hematomas occurs through two main mechanisms. First, the disruption of blood circulation to the cartilage leads to necrosis. Second, this results in cartilage degeneration, which is replaced by fibrous tissue and new cartilage formation that develops from the activation of mesenchymal stem cells in the perichondrium. Calcification and ossification are also observed in affected areas. (14) (7) (5)

Treatment of Auricular Heamatoma

After a traumatic event, the patient should be questioned about hearing issues and undergo an otoscopic examination, as blunt trauma often results in tympanic membrane perforation, which may require further assessment and treatment. A detailed history must be taken to determine the time since the hematoma's onset and any recurrence. While waiting for the examination and further procedures, ice compression can be applied for less than 20 minutes. (15) (11) Next, it is important to drain the accumulated fluid. Hematoma drainage can be performed either by needle aspiration or through an incision, depending on the size and duration. For hematomas present for over 6 hours or those that are larger or recurrent, an incision through the anatomical lines, such as the helical rim, and irrigation with sterile saline solution of the subperichondrial space or surgical debridement are usually necessary. In contrast, smaller or softer hematomas can often be successfully aspirated with a needle (18–20 gauge). When performing needle aspiration, a local field block of the greater auricular nerve using 2% lidocaine and epinephrine is recommended. The injection should be superficial to avoid complications like Horner’s syndrome, phrenic nerve block, or subarachnoid block. (15) Systemic antibiotics are advised to cover normal skin flora and Pseudomonas if incision and drainage are required. (16)

The next step is to apply pressure to the drained area, which is a crucial measure to minimize the risk of recurrence. The study by Dalal et al. highlights that bolster dressings (while bolster in this study was being defined as any method that applies consistent compression and minimizes dead space in the ear) significantly reduce auricular hematoma recurrence, with only 14% recurrence in treated cases compared to 60% without. (17) The methods of

compression vary and should prioritize patient comfort, be cost-effective, simple and low-risk to apply, minimize the risk of infection, and support a quick return to training—an important consideration for athletes. (16) (19)

Cotton materials

One of the earliest described methods involved using bolsters made of cotton. A 1968 study presented using collodion-soaked cotton wool to create a pressure-maintaining mold after aspiration, filling ear creases with cotton and layering more collodion-soaked wool for a firm fit. This method effectively prevented recurrence, but patients had to avoid sports for 10 days. (20) Another technique described by Cochran et al. involved using sterile cotton with antibiotic ointment, molded to fill the space between soft tissue and cartilage, and secured with silk sutures. The sutures passed through small pieces of rubber tubing posteriorly, tying the bolster in place. The bolster was left for a week, with oral antibiotics given during and after removal, effectively preventing fluid reaccumulation and restoring normal contour. Gernon's study involved 47 patients treated with the aspiration and compressing method using White Wool and Webril(cotton) soaked in collodion. White Wool was molded to the conchal area of the ear, soaked in flexible collodion, and carefully contoured to maintain pressure and stabilize the area. For the helical region, Webril, also soaked in collodion, was used and molded to the ear's convolutions. This provided continuous support, and after the first application, a second layer of collodion was applied to further secure the compress. The technique showed excellent results in 40 patients, with a recurrence rate of about 30%, especially in those who continued their sports activities. In these cases, a second aspiration was required, and fewer than 10% needed a third aspiration. (21)

Dental Rolls

The technique described by Koopman & Coulthard involved aspirating the hematoma, followed by the application of sterile dental rolls soaked in bacitracin ointment. These rolls were carefully molded over the affected area of the auricle, both anteriorly and posteriorly. To secure them in place and maintain pressure on the hematoma site, the rolls were sutured using silk. (22) The study concluded by Sbaihat et al. refers that incision and drainage followed by suturing two dental rolls for compression was the most effective method for preventing auricular hematoma recurrence, compared to simple aspiration with pressure dressing and incision with drainage followed by pressure dressing. However, statistical analysis showed no

significant difference between the treatment methods (p-value = 0.231), likely due to the small sample size of 45 patients. This suggests the need for further research to confirm these findings. (23) Another research described a technique for auricular hematoma management using dental rolls. After aspiration and drainage, a mattress suture was applied to compress the auricular skin, perichondrium, and cartilage, while dental rolls impregnated with antibacterial ointment maintained adequate pressure. A mastoid dressing was applied immediately after the procedure and removed the following day. The study involved 19 high school or collegiate wrestlers who underwent treatment for 24 auricular hematomas. Patients were permitted to resume strength training on the same day as the procedure, and after the mastoid dressing was removed the following day, they were allowed to return to wrestling practice or competition. A quick return to physical activity is an advantage of this method. The dental rolls were removed after two weeks without the need for anesthesia. The results indicated a low recurrence rate and no permanent deformities, however, it still involved an invasive procedure, carrying a potential risk of infection. In this study, two wrestlers experienced infections due to subsequent trauma to the ear after the stitch dressing application. (19)

Magnetic disc

The case report by Haik et al. describes an 18-year-old judo athlete who presented with an auricular hematoma. The hematoma was evacuated through needle aspiration. The innovative technique involved the use of a magnetic disk system for post-aspiration compression. A strong magnet was placed behind the ear, while a cotton-covered metal disc was positioned on the front, providing adjustable pressure to stabilize the skin, perichondrium, and cartilage without causing additional trauma. However, the hematoma required drainage up to three times over three days. After one month, the treatment outcome was satisfactory, and the auricular contours were restored. The authors emphasize that the main benefit of this approach is its ability to distribute pressure evenly, effectively eliminating dead space on the anterior auricular surface. Additionally, magnets facilitate easy wound monitoring. (24)

The use of magnets was also described in a case report by Wan Wei et al., but it led to a significantly worse outcome. In this instance, two magnets were used instead of a magnet paired with a metal disc, contributing to the complications.

A wrestler in his 20s sustained a left auricular hematoma, which his coach aspirated. Commercially available magnets were then applied on both sides of the pinna to prevent reaccumulation, as advised by the device producer. The patient continued using the magnetic discs over the wound site for five consecutive days without any medical evaluation or oversight. On day 5, he removed the magnets and noticed reaccumulation of the hematoma, which he attempted to aspirate multiple times. When the attempts failed, he attended A&E. At A&E, signs of perichondritis were evident, and upon removal of the magnets, severe pressure necrosis was revealed, with blackened, necrotic skin and cartilage erosion. The hematoma had also reaccumulated. Treatment involved surgical drainage, a pressure dressing with dental rolls, and oral antibiotics. Despite follow-ups, the patient developed a permanent helical rim deformity, and cartilage augmentation was recommended three months later. This case highlights the risks of improper magnet use and the lack of medical oversight, stressing the importance of careful management and patient counseling to avoid long-term complications. The excessive pressure from the magnets led to tissue necrosis, hindered healing, and caused an infection that spread to the cartilage, resulting in perichondritis. (25)

Drainage

The study by Bull et al. introduced a suction drainage method to address the limitations of traditional compression techniques, which often fail to provide adequate pressure on concave regions. Under general anesthesia, a posterior incision was made, and a 5 mm cartilage disc was excised to access the hematoma. The hematoma was evacuated using suction, irrigation, and curettage, and a Redivac suction drain was inserted into the subperichondrial dead space to maintain continuous drainage. The drain was secured, and the incision was closed with non-absorbable sutures. The suction drain remained in place for seven days, after which it was removed, and all six patients achieved a near-normal appearance of the pinna. This technique demonstrated effective hematoma management, preventing reaccumulation and addressing the shortcomings of pressure dressings alone. (26) Another investigation into the treatment of auricular hematomas using continuous vacuum drainage was made by Eliachar et al.. The procedure involved local anesthesia, a small incision at the most dependent part of the hematoma, aspiration, and insertion of a Branula® cannula for continuous drainage. The drainage lasted for one to two days. In a cohort of 23 patients, the method demonstrated excellent results in 21 cases, with no infections, recurrences, or deformities. (27) Another

research describes the use of aspiration and drainage with an angiocatheter for treating acute auricular hematomas in 53 male high school wrestlers. After aspiration, the catheter was left in place for 3 to 5 days, with a compression dressing applied. Follow-ups on days 1, 3, 5, and 7 showed that 94.3% of patients had successful hematoma evacuation. After the removal of the catheter, athletes were allowed to return to workouts, although contact sports were prohibited. Athletes were cleared to return to wrestling on day 7 following the initial procedure. Despite the effectiveness of this drainage method in preventing recurrence, athletes were required to temporarily halt their training, which might be inconvenient for them. (28)

Matress sutures

A study presented by Vyuk describes a successful use of a continuous mattress suture technique, similar to that used in septoplasty (nasal surgery), for the treatment of auricular hematoma. This technique involves a continuous running suture with a straight needle, passed through the posterior skin, cartilage, and anterior skin in a mattress-like fashion. The goal is to securely fix the perichondrium to the cartilage, eliminating dead space. A fast-absorbing catgut suture was used to minimize irritation, and a cotton wool bolster tie-over dressing was applied for four days to aid healing. After the procedure, antibiotic ointment was applied for two weeks. (28) Between 1998 and 2010, Kakarala et al. evaluated the mattress suture technique with absorbable materials in 28 patients with recurrent auricular hematomas. The approach used through-and-through absorbable horizontal mattress sutures (4.0 or 5.0 plain or fast-absorbing gut sutures). The number of sutures varied and they were placed every 4 to 5 mm to contour the auricular skin and soft-tissue envelope to the cartilage. Bacitracin or sterile petrolatum ointment was applied to the incision, and a loose ear dressing was used for 48 hours. Oral antibiotics were prescribed. Patients were followed up at 1 week, 2 weeks, and 8 to 12 weeks to evaluate recurrence and assess cosmetic results. This technique was used not only for patients' sports-related injuries but also for cases linked to developmental disabilities, assaults, and other causes. This approach effectively managed difficult recurrent auricular hematomas, did not require any subsequent removal procedure, unlike bolster techniques and ensured even compression. Excellent cosmetic results and no recurrence were observed. (29) A subsequent study conducted on Indian wrestlers, analyzing 40 cases of auricular hematoma treated between September 2014 and September 2017, confirmed the effectiveness of the mattress suture technique. The surgical method involved incision and

drainage, followed by the application of absorbable mattress sutures. Satisfactory cosmetic results were observed post-treatment. No reoccurrence was observed postoperatively. The evaluation took place on the 3rd, 6th, and 10th days, followed by subsequent assessments at 3 months and 6 months. During the 6-month evaluation, 8 patients experienced a second hematoma on the same ear but in a different location. (30)

Hole punch technique

A novel surgical technique has emerged as a promising solution for managing recurrent auricular hematomas, a condition often resistant to conventional treatments. The "hole-punch" method involves creating an incision along the damaged cartilage, lifting a soft tissue flap, removing the deformed anterior cartilage layer, and punching 3 mm holes in the remaining cartilage. This approach was applied to five cases of persistent, post-traumatic recurrent auricular hematomas that had previously failed with at least two drainage attempts. Treatment included open drainage, cartilage perforation, and application of a xeroform bolster for 5 to 21 days. All patients achieved excellent outcomes, with no recurrences or cauliflower deformities. This technique proves to be an effective solution for managing challenging cases of recurrent auricular hematomas. (31)

Fibrin glue

An innovative surgical technique, detailed by Mohamad et al., addressed 5 challenging cases, including two with recurrent hematomas and others presenting late (6, 21, and 28 days post-injury). The procedure involved cleaning the skin with chlorhexidine and anesthetizing with lidocaine and adrenaline, supplemented by a great auricular nerve block. A small incision was made along the natural creases of the pinna to access the hematoma, which was completely drained. Tisseel, a fibrin sealant containing fibrinogen and thrombin to promote hemostasis, was applied to the cavity. Compressive dental rolls were placed on either side of the pinna and secured with proline sutures. Patients received co-amoxiclav antibiotics and were reviewed after five days for suture and dressing removal. Follow-ups confirmed no recurrence, with surgeons and patients satisfied with the aesthetic outcomes and no complications reported. This case series indicates that the binding properties of fibrin glue may aid in avoiding the re-formation of auricular hematomas. (32)

OK-432

An innovative and promising approach for managing auricular hematomas was introduced by Japanese scientists in 2010, involving the use of OK-432. This compound is a freeze-dried formulation derived from the Su-strain of Group A Streptococcus, treated with penicillin, and was initially developed for cancer immunotherapy. Its therapeutic action relies on triggering a localized inflammatory response by activating immune cells such as neutrophils and monocytes, which stimulates cytokine release, promotes lymphatic drainage, and reduces fluid-filled or cystic spaces. This technique, previously effective in treating lymphangiomas and branchial cleft cysts, presents a novel and potentially safer alternative for addressing auricular hematomas. The research included 21 individuals who received OK-432 injections to address auricular hematomas from 2001 to 2009, administered in an outpatient setting. On the second day following the injection, the hematoma was punctured, and fluid was aspirated. Follow-up assessments were conducted on days 2, 7, 14, and 28 post-injection, with treatment responses evaluated between weeks four and six. For cases where the outcome was insufficient, the procedure was repeated with a doubled dose of OK-432. Patients required between one and five sessions (average 1.3), resulting in complete resolution in 20 cases and no recurrences observed over an average follow-up of 13.1 months (range 4–38 months). Adverse effects were minimal, including brief fever controlled with antipyretics and no instances of infection, abscess formation, or skin scarring were reported. OK-432 therapy offers benefits such as a brief procedure, no local anesthesia, painless application, and a low risk of complications and it is at least comparable in effectiveness to other treatments for auricular hematoma. The authors concluded it is a simple, safe, and effective alternative to other types of treatment of this condition. However, this study did not include a control group.

(33) A similar study was conducted in 2019 on a larger population. 47 patients with auricular hematoma were treated between April 2008 and August 2018. The fluid content from each lesion was aspirated using a 21-gauge needle, followed by an injection of OK-432 solution into the lesion using the same needle. The procedure was performed on an outpatient basis without the need for hospitalization. On the seventh day post-injection, the swollen auricular hematoma was punctured again with a 20-gauge needle, and as much fluid as possible was aspirated. Examinations were conducted on days 7, 28, and 42 after injection to assess the response. If the response was insufficient, the therapy was repeated with a 100% increase in OK-432. In this study, a total of 58 treatments were administered across 47 ears,

with 43 of the 47 patients requiring only a single session dosage. This study also included the measurement of cytokine levels in the aspirate fluid collected from patients 7 days after the OK-432 injection. The concentrations of tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6), interleukin-8 (IL-8), interferon gamma (IFN-γ), vascular endothelial growth factor (VEGF) and periostin were significantly elevated in the aspirate fluid compared to pre-treatment levels, indicating a strong inflammatory response following the therapy. The authors concluded that OK-432 therapy is more advantageous than surgical methods in both economic terms and cosmetic outcomes. (34)

Steroid administration

A study conducted in South Korea compared the effectiveness of aspiration combined with intralesional steroid injection- undiluted triamcinolone (40 mg/mL) was used in volumes of 0.5 to 1.5 mL- to aspiration followed by pressure dressing for managing otohematoma. In this study, all cases of otohematoma were successfully treated with steroid injections without complications, and the treatment duration was shorter compared to the pressure dressing group. However, a major drawback is the risk of recurrence, both early and late. In 44.1% of cases, a second steroid injection was needed, and in 14.7%, a third injection was required after one week. Additionally, 14.7% of cases experienced late recurrences after the initial cure. Otohematoma resolved within four weeks in all 15 patients treated with pressure dressing, though eight of these patients developed perichondrial thickening. The authors emphasize that steroid injections should not be used in cases with an infected ear, large otohematomas, repeatedly traumatized ears, or severe fibrous-organized hematomas that are hard to aspirate. Recurrence is more likely when the otohematoma is located within cartilage, and in such instances, surgical methods are preferred. The authors suggest that aspiration with intralesional steroid injection is a more efficient, less invasive, and patient-friendly approach. They advocate its use as the primary treatment for uncomplicated otohematoma. A previous 2000 study conducted by Park et al. also demonstrated that treating otohematoma with triamcinolone injections after hematoma or seroma aspiration is highly effective. Among 100 patients, 96% recovered fully without complications, with most requiring no more than three injections. (35)

Other techniques requiring the use of certain types of sutures

An interesting method presented by Talaat et al. involved the use of sterile buttons. In this study, 10 male patients were treated using a technique where the hematoma was evacuated, and sterile buttons were placed on either side of the auricle, secured with through-and-through silk sutures. The buttons remained in place for one week, during which patients were also prescribed oral antibiotics. The outcomes were highly successful, with all patients showing complete restoration of the auricle's normal contour after button removal. No recurrences were observed during a 6-month follow-up period. (36) The authors of another study described a successful method for treating auricular hematomas using silicone sheets. Following sterilization and local anesthesia, the hematoma was drained through a small incision. Thin Silastic sheets were applied to the anterior and posterior auricle surfaces and secured with nylon mattress sutures for effective compression. The wound was treated with antibiotic ointment and standard dressing, with all materials removed after one week, yielding good outcomes. (37) Other successful method for managing auricular hematomas using thermoplastic splints was described in the next study. After administering local anesthesia, a 5-mm incision was made along the scaphoid fossa to drain the hematoma through blunt dissection in the subperichondrial plane. A single suture was placed to approximate the tissues while allowing ongoing drainage. Thermoplastic splints (Aquaplast) were trimmed to fit the anterior and posterior surfaces of the auricle. These splints were softened in warm water, molded to the auricle under firm pressure, and allowed to harden into a rigid form that conformed to the ear’s natural shape. The splints were secured with through-and-through nylon sutures, and a protective gauze dressing was applied. The patient was sent home the same day with prescriptions for oral antibiotics and pain medication. After one week, the splints and sutures were removed, showing restored auricular structure and reduced bruising. By the two-week checkup, there was no recurrence or infection, and the one-month follow-up confirmed complete recovery, confirming the procedure's effectiveness and safety. (38)

Other less invasive techniques

An effective method for treating auricular hematoma is described in the article by Grosse et al. utilizing a swimmer’s nose clip. The procedure involves aspirating the hematoma, applying a layer of collodion to the auricle, soaking cotton in the collodion solution, and placing a swimmer’s nose clip to exert continuous pressure. Additional layers of cotton and gauze are added to secure the compression. The recommendations for patients treated with this method,

provided by the authors, include keeping the cast dry, avoiding sweating or showering. The cast should be worn for up to 10 days, and the area should be checked daily for signs of infection, pressure necrosis, or allergic reaction. This technique has been successfully used on around 120 athletes, enabling them to return to sports without interruption. However, due to the specific conditions required for wearing the cast, it may temporarily prevent the athlete from training. (39) The use of an aluminum finger splint as a compression device was found to be effective in preventing the re-accumulation of hematoma after aspiration, as described in a study by Khan et al., though it was applied in a pediatric case. (40) The study by Choung et al. introduced dental silicone as a novel and effective method for treating auricular hematomas. This technique involves the application of a mixed base and catalyst of silicone putty material, shaped into an inverted U on both the anterior and posterior surfaces of the auricle, which is then left in place for seven days. The material used is Exaflex dental impression material, known for its short setting time, high hardness, tensile strength, and minimal dimensional change. The silicone sets in place, preserving the anatomical contour of the auricle and allowing for compression. The hardened dental mold is fixed and stabilized using paper tape, then covered with gauze. Antibiotics are not necessary. The patient is checked again three days post-procedure, and on the seventh day, the impression material is removed. This method can be performed in around 10 minutes. From the 24 cases treated using the dental silicone compression technique, 23 (95.8%) were successfully healed. Most patients required only one aspiration, while five cases needed a second aspiration to remove fluid accumulation. One of these experienced a recurrence after two weeks, but healing was achieved with the reapplication of dental silicone. One patient needed aspiration three times, but the final cosmetic result was good. In total, this method provided effective outcomes, with only minor adjustments needed for a few cases. (41)

Treatment of Cauliflower Ear

If the prevention of the formation of wrestler's ear and the evacuation of the auricular hematoma fails, there is still a chance to treat the patient's condition. Currently, surgical approaches are used to remove the deformed, newly formed cartilage and restore the patient's health and comfort. When planning incisions for cartilage reconstruction, it is essential to account for the ear's interconnected vascular systems—the conchal and triangular fossa-

scapha networks—to maintain proper blood flow, avoiding harm to critical vessels such as the helical root perforators and those supplying the conchal region. (42) The study by Yotsuyanagi et al. concluded that selecting an incision line and reconstructive technique aligned with the deformity's zone and severity is the critical factor in achieving successful outcomes for patients with cauliflower ear. The authors proposed a classification of cauliflower deformity that helps the surgeons. Type I deformities, characterized by minor structural changes, involve targeted interventions: Type IA addresses conchal deformities with cartilage excision via conchal margin incisions; Type IB requires scaphoid fossa or post-helical incisions to reshape or graft cartilage for antihelix-helix issues; Type IC, affecting the entire ear, uses combined conchal margin and post-helical incisions with costal-cartilage grafts for reconstruction if ossification is extensive. For Type ID, with associated skin defects, postauricular flaps are employed to cover deficiencies and reduce recurrence risks. In Type II deformities, which involve significant structural alterations, the approach depends on cartilage integrity. Type IIA utilizes conchal and post-helical incisions, with conchal-cartilage grafts restoring contour while preserving elasticity. Type IIB addresses poor cartilage integrity through postauricular incisions and costal-cartilage grafting to rebuild support. The authors reported favorable outcomes in all four patients treated, noting significant improvements in ear shape and contour as well as the resolution of functional complications. (42) Other researchers- Xu Ma et al. have proposed a new classification because sometimes, as referred, the changes in the ear are too subtle to define clearly and too complex to fully understand the formation of the deformity. A simplified approach for preoperative planning in cases of cauliflower ear was developed. Helix deformity refers to a distorted or uneven helix, which can be addressed through an incision at the top of the posterior ear. A scaphoid fossa deformity involves thickened tissue in the scaphoid fossa, obscuring the helix, and requires an incision at the top of the posterior ear. Deformities in the antihelix crura and triangular fossa involve alterations in the antihelix crura and triangular fossa, which can be corrected with an incision along the upper medial edge of the antihelix. The antihelix body deformity, characterized by a widened or thickened antihelix, can be treated with an incision along the middle medial edge of the antihelix. Lastly, a concha deformity involves excess tissue in the concha, which can be addressed through an incision along the middle and lower medial antihelix edge. (13) Another method described in studies involves cartilage grafting to restore the normal ear shape after scar contracture release and removal of excess tissue. The

grafts can be harvested from the conchal or costal cartilage, providing structural support and enabling the reconstruction of the ear. (42) Putri et al. reported a successful case of ear reconstruction utilizing a costal cartilage framework crafted with the aid of a three-dimensional cutting guide for accurate surgical preparation. Costal cartilage was chosen due to its durability, firmness, and natural curvature, which aligns well with the shape of the external ear. The procedure was carried out without any complications, achieving remarkable ear projection and form. The patient suffered from cauliflower ear as a result of an infection in childhood, not due to sport. However, this method can be applied in all cases. (43) Another researcher introduced an innovative, minimally invasive technique for correcting cauliflower ear, based on the Valente otoplasty method. The procedure began with a bi-elliptical incision in the postauricular skin, exposing the underlying cartilage. Deformed cartilage was carefully excised using a scalpel and diamond burr. Excess tissue was removed, followed by contour restoration using mattress sutures and skin redistribution over the cartilage framework. The procedure was performed on 7 pediatric patients (9 ears), showing favorable aesthetic results with sustained improvements in ear contour and symmetry, no recurrence of deformity, and high patient satisfaction. (44) A compelling study conducted by Hao et al. describes a case report with the use of the ultrasonic aspirator in cauliflower ear surgery. The ultrasonic aspirator is a precision tool designed for selective and controlled removal of bone and cartilage, minimizing damage to surrounding soft tissues and is preferred over drills and microdebriders. It is widely used across various surgical fields, including neurosurgery, renal surgery and otolaryngology. The procedure began with hydro-dissection using 1% lidocaine, followed by a scaphal incision to elevate the skin flap. The ultrasonic aspirator, set to 100% oscillation, sculpted the fibrosed cartilage to restore ear contour. Four months later, the second stage refined the conchal bowl using similar techniques. Postoperatively, the patient achieved excellent auricular shape and symmetry, with high satisfaction reported. This approach demonstrates the ultrasonic aspirator’s effectiveness in achieving precise, esthetic outcomes in the treatment of cauliflower ear. (45)

Consequences of neglect and methods of prevention

Cauliflower ear, if left untreated, can lead to serious consequences. A study conducted in Tehran examined 340 wrestlers aged 15 to 25, including 201 wrestlers with cauliflower ears (100 with one ear and 101 with two ears) and 139 without. The results showed that cauliflower ear was associated with a higher prevalence of hearing loss (25.4% vs. 14.4%) and a greater history of ear infections (8.4% vs. 4.9%) (46) . A different study also investigated this issue, including 28 male wrestlers aged 18–35 years with bilateral cauliflower ears, as well as 27 male participants in the control group with no wrestling history. This research also concluded that cauliflower ear contributes to hearing loss- wrestlers with bilateral cauliflower ears had significantly higher hearing thresholds, particularly at frequencies above 4000 Hz, and a shift in EEC resonance frequencies, indicating a direct impact of the deformity on auditory function. (47) Wrestler's ear also causes discomfort in daily activities such as sleeping, using headphones or using a stethoscope. Additionally, some patients are bothered by the visual aspect of the deformity. (42) In contrast, an interesting research paper revealed that combat sports athletes view individuals with cauliflower ear much more favorably than the general population, scoring them higher in areas such as perceived success, attractiveness, and approachability. This highlights how conditions typically seen as deformities can be viewed more favorably in certain subgroups. Doctors should consider the social context and motivations of patients when advising on treatment options for cauliflower ear. (48) The best way to prevent the formation of an auricular hematoma seems to be wearing protective headgear. However, there is very limited research examining the use of protective headwear or helmets in the context of auricular hematoma formation in combat sports athletes and this topic should be further explored. A study with 537 Division I collegiate wrestlers found that there was a statistically significant difference in the development of auricular hematoma while wearing headgear (26%) compared to not wearing headgear (52%). The headgear was often worn reluctantly during training—only 35.2% of the wrestlers wore it consistently during practice, compared to 92.4% during competition. (49) Furthermore, prompt medical attention, draining the hematoma, and applying some form of compression remain the most effective preventive methods to avoid cauliflower ear formation. (11)

Conclusions

Different approaches to managing auricular hematoma offer varying benefits and limitations. Traditional methods such as cotton or wool compression are simple,non-invasive and cost-effective but can be uncomfortable and may restrain the patient from sport for some time. The dental roll technique provides adequate compression at a low cost, provides quick return to activity, however, it may lead to high recurrence, and it is more invasive than cotton bolsters. Mattress sutures offer secure compression and low recurrence rates but also involve minor surgical intervention. The use of magnetic disks carries significant risk and needs further investigation. OK-432 and steroid injections are modern, minimally invasive techniques with the lack of need for local anasthesia and painless application. However, steroid injections require careful patient selection –they should be used in mild cases only and they have a high recurrence rate – the injections often must be performed more than once to achieve the goal, which is burdensome for the patients. OK-432 appears to be a better choice, with fewer complications and greater effectiveness. However, it may also need to be repeated several times over time. For recurrent heamatomas, surgical options like hole punch technique and fibrin glue seem to offer a promising solution. In the treatment of cauliflower ear, both classifications mentioned by Yotsuyanagi et al. and Xu Ma et al. provide a thorough analysis of the condition and appear highly useful. The use of ultrasonic aspirators and grafts also seems to be very promising for future applications. However, a drawback of the ultrasonic aspirator is that the procedure may need to be repeated after four months to achieve the desired outcome. It has been established that ear deformities carry a risk of hearing loss, highlighting the need for spreading awareness and educating athletes about prevention through the use of the headgear. It is important to understand athletes' perspectives and engage them in conversations to convince them of its necessity. Additionally, education should focus on the immediate and appropriate response when a hematoma occurs, emphasizing the importance of drainage combined with the best form of compression at the time, as this is more effective than neglecting treatment. Regular follow-ups and evaluations are crucial after starting compression therapy. Many of these studies lack control groups, were conducted on small patient populations, or were performed a long time ago. There is a need for more extensive research and further exploration of the topic to establish more reliable and up-to-date evidence.

Disclosure

Author's Contributions:

Conceptualization – Julia Kiełbratowska; Methodology – Julia Kiełbratowska, Przemysław Klasicki, Wiktoria Pietruszka, Jan Mateńko; Software – Michał Pałuchowski, Wiktor Możarowski, Agata Krupa; Verification – Maciej Mozer, Anna Krawczyk, Michał Pałuchowski, Maria Potrykus, Wiktor Możarowski; Formal analysis – Agata Krupa, Wiktor Możarowski, Maria Potrykus, Jan Mateńko; Investigation – Julia Kiełbratowska, Maciej Mozer, Michał Pałuchowski, Przemysław Klasicki; Resources – Julia Kiełbratowska, Anna Krawczyk, Przemysław Klasicki, Maria Potrykus, Wiktoria Pietruszka; Data curation – Wiktoria Pietruszka, Przemysław Klasicki, Maciej Mozer, Agata Krupa; Writing (draft preparation) – Julia Kiełbratowska, Jan Mateńko, Wiktoria Pietruszka, Maria Potrykus, Anna Krawczyk; Writing (review and editing) – Maciej Mozer, Agata Krupa, Wiktor Możarowski, Michał Pałuchowski; Visualization – Jan Mateńko, Wiktoria Pietruszka, Przemysław Klasicki, Michał Pałuchowski; Supervision – Julia Kiełbratowska; Project administration – Julia Kiełbratowska.

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References:

1. Gastoł B, Mikołap K, Staroń A, Kras M, Karkos P, Kuśmierczyk K, et al. Comparison of the incidence and causes of injuries in stand-up and ground combat-sport fighters – a narrative review. Quality in Sport. 2024.18:53419. https://doi.org/10.12775/QS.2024.18.53419
2. Schuller DE, Dankle SK, Martin M, Strauss RH. Auricular Injury and the Use of Headgear in Wrestlers From the Departments of Otolaryngology. Arch Otolaryngol Head Neck Surg.1989;115: 714–717. https://doi.org/10.1001/archotol.1989.01860300068019
3. Manninen IK, Blomgren K, Elokiuru R, Lehto M, Mäkinen LK, Klockars T. Cauliflower ear among Finnish high-level male wrestlers and judokas is prevalent and symptomatic deformity. Scand J Med Sci Sports. 2019 Dec 1;29(12): 1952-1956. https://doi.org/10.1111/sms.13530
4. Nitsch A, Marx H, Fischer CS, Bakir S, Ekkernkamp A, Wassilew GI, et al. Prevalence of cauliflower ear in high level judoka. Sci Rep. 2023 Dec 1;13(1). https://doi.org/10.1038/s41598-023-42635-8
5. Ohldn L, Skoog T, Sohn SA. The pathogenesis of cauliflower ear. An experimental study in rabbits. Scand J Plast Reconstr Surg. 1975;9(1):34-39. https://doi.org/10.3109/02844317509022854
6. Pandya NJ. Experimental production of "cauliflower ear" in rabbits. Plast Reconstr Surg. 1973 Nov;52(5):534–537. https://doi.org/10.1097/00006534-197311000-00010
7. Vogelin E, Grobbelaar AO, Chana JS, Gault DT. Surgical correction of the cauliflower ear. Br J Plast Surg.1998. 51(5): 359-362. https://doi.org/10.1054/bjps.1997.0033

8. Haik J, Givol O, Kornhaber R, Cleary M, Ofir H, Harats M. Cauliflower ear - A minimally invasive treatment method in a wrestling athlete: A case report. Int Med Case Rep J. 2018;11:5-7
https://doi.org/10.2147/IMCRJ.S152145
9. Noormohammadpour P, Rostami M, Nourian R, et al. Association Between Hearing Loss And Cauliflower Ear in Wrestlers, a Case Control Study Employing Hearing Tests. Asian J Sports Med. 2015;6(2):e25786.
https://doi.org/10.5812/asjsm.6(2)2015.25786
10. Hunter A, Frias JL, Gillessen-Kaesbach G, Hughes H, Jones KL, Wilson L. Elements of morphology: Standard terminology for the ear. Am J Med Genet A. 2009;149(1):40–60.
https://doi.org/10.1002/ajmg.a.32599
11. Greywoode JD, Pribitkin EA, Krein H. Management of auricular hematoma and the cauliflower ear. Facial Plastic Surgery. 2010;26(6):451-455
https://doi.org/10.1055/s-0030-1267719
12. Dudás B. Human Histology Academic Press. 2023: 49–71.
https://doi.org/10.1016/B978-0-323-91891-6.50014-3
13. Ma X, Dai X, Zhang D, Xiong Z, Wang B, Li J, et al. A Subunit-Based Concept for Preoperative Design of the Cauliflower Ear. Journal of Craniofacial Surgery. 2024;35(8): 2492–2496
https://doi.org/10.1097/SCS.0000000000010634
14. Mashiko T, Minabe T, Shiokawa I, Mineda K, Yoshimura K. Heterotopic ossification in cauliflower ear. J Plast Reconstr Aesthet Surg. 2014;67(3):e93-e94
https://doi.org/10.1016/j.bjps.2013.10.015
15. Summers A. Managing auricular haematoma to prevent “cauliflower ear.” Emergency Nurse. RCN Publishing Company Ltd. 2012; 20: 28–30.
16. Gooch MD. Preventing Cauliflower Ear. Adv Emerg Nurs J. 2020;42(3): 204–209.
17. Dalal PJ, Purkey MR, Price CPE, Sidle DM. Risk factors for auricular hematoma and recurrence after drainage. Laryngoscope. 2020;130(3):628–631.
https://doi.org/10.1002/lary.28310
18. Butt WE. Auricular Heamatoma- Treatment Options. Aust NZJ Surg. 1987; 57: 391–392.

19. Schuller DE, Dankle SD, Strauss RH. A technique to treat wrestlers' auricular hematoma without interrupting training or competition. Arch Otolaryngol Head Neck Surg. 1989;115(2):202-206.
20. Stuteville OH, Janda C, Pandya NJ. Treating the injured ear to prevent a "cauliflower ear." Plast Reconstr Surg. 1969;44(3):310-312.
21. Gernon WH. The care and management of acute hematoma of the external ear. Laryngoscope. 1980;90:881-885.
22. Koopmann C, Coulthard S. Management of hematomas of the auricle. Laryngoscope. 1979; 89: 1172-1174
23. Sbaihat AS, Khatatbeh WJ. Treatment of auricular hematoma using dental rolls splints. J R Med Sci. 2011;18(2):22-25.
24. Haik J, Givol O, Kornhaber R, Cleary M, Ofir H, Harats M. Cauliflower ear - A minimally invasive treatment method in a wrestling athlete: A case report. Int Med Case Rep J. 2018; 11:5–7. https://doi.org/10.2147/IMCRJ.S152145
25. Ang WW, Foley G, Laycock J, McKay-Davies I. Ear magnetic discs to prevent cauliflower ear: a case gone wrong. BMJ Case Rep. 2022;15(11): e250864. https://doi.org/10.1136/bcr-2022-250864
26. Bull PD, Lancer JM. Treatment of auricular haematoma by suction drainage. Clin Otolaryngol. 1984;(9):355–60.
27. Eliachar I, Golz A, Joachims HZ, Goldsher M. Continuous portable vacuum drainage of auricular hematomas. Am J Otolaryngol. 1983;4(2):141-143
28. Vuyk HD, Bakkers EJ. Absorbable mattress sutures in the management of auricular hematoma. Laryngoscope. 1991;101(10):1124-1126. https://doi.org/10.1288/00005537-199110000-00015
29. Kakarala K, Kieff DA. Bolsterless management for recurrent auricular hematoma. Laryngoscope. 2012;122(6):1235–7. https://doi.org/10.1002/lary.23288
30. Kirdak VR, Chintale SG, Shaikh K, Jatale S. Our experience of auricular hematoma treatment in wrestlers. International Journal of Otorhinolaryngology and Head and Neck Surgery. 2018;4(2):440. https://doi.org/10.18203/issn.2454-5929.ijohns20180704.

31. Lamb MM, Mims MM, Clark JM. “Hole-Punch” Technique for Recurrent Auricular Hematomas. Laryngoscope. 2023;133(4):814–7. https://doi.org/10.1002/lary.30298
32. Mohamad SH, Barnes M, Jones S, Mahendran S. A new technique using fibrin glue in the management of auricular hematoma. Clin J Sport Med. 2014;24(6):e65-e67. https://doi.org/10.1097/JSM.0000000000000095
33. Kubota T, Ohta N, Fukase S, Kon Y, Aoyagi M. Treatment of auricular hematoma by OK-432. Otolaryngology - Head and Neck Surgery. 2010:142(6):863–866. https://doi.org/10.1016/j.otohns.2010.03.006
34. Ohta N, Fukase S, Kusano Y, Saito Y, Tateda Y, Ishida Y, et al. Treatment of auricular hematomas by OK-432: How and why it works. Otology and Neurotology. 2019;40(8):E820–823. https://doi.org/10.1097/MAO.0000000000002336
35. Im GJ, Chae SW, Choi J, Kim YS, Kim WJ, Jung HH. Intralesional steroid injection for the management of otohematoma. Otolaryngology - Head and Neck Surgery. 2008: 139(1):115–119. https://doi.org/10.1016/j.otohns.2008.01.006
36. Talaat M, Azab S, Kamel T. Treatment of auricular hematoma using button technique. ORL J Otorhinolaryngol Relat Spec. 1985;47(4):186-188. https://doi.org/10.1159/000275768
37. Rah YC, Park MH. Use of silastic sheets with mattress-fashion sutures for the treatment of auricular hematoma. Laryngoscope. 2015; 125(3):730–732. https://doi.org/10.1002/lary.24976
38. Henderson JM, Salama AR, Blanchaert RH Jr. Management of auricular hematoma using a thermoplastic splint. Arch Otolaryngol Head Neck Surg. 2000;126(7):888-890. https://doi.org/10.1001/archotol.126.7.888
39. Grosse SJ, & LJM. Treating Auricular Hematoma Success With a Swimmer’s Nose Clip. The Physician and Sportsmedicine. 199; 19(10), 98–102.
40. Khan A, Kwiatkowski T. A novel technique: Use of finger splint as compression device for post auricular hematoma drainage. Am J Emerg Med. 2022;56:286-287 https://doi.org/10.1016/j.ajem.2021.07.023

41. Choung YH, Park K, Choung PH, Oh JH. Simple compressive method for treatment of auricular haematoma using dental silicone material. J Laryngol Otol. 2005;119(1):27-31.
https://doi.org/10.1258/0022215053222932
42. Yotsuyanagi T, Yamashita K, Urushidate S, Yokoi K, Sawada Y, Miyazaki S. Surgical correction of cauliflower ear. Br J Plast Surg. 2002;55(5):380-386
https://doi.org/10.1054/bjps.2002.3854
43. Putri IL, Bogari M, Khoirunnisa A, Dhafin FR, Kuswanto D. Surgery of Severe Cauliflower Ear Deformity. Plast Reconstr Surg Glob Open. 2023;11(4):e4953.
https://doi.org/10.1097/GOX.0000000000004953
44. D'Ascanio L, Gostoli E, Ricci G, De Luca P, Latini G, Brenner MJ, et al. Modified Valente Technique for Cauliflower Ear: Outcomes in Children at Two-Year Follow-Up: New Surgical Technique for Cauliflower Ear. Aesthetic Plast Surg. 2024; 48(10):1906–1913.
https://doi.org/10.1007/s00266-024-03914-5
45. Hao S, Angster K, Hubbard F, Greywoode J, Vakharia KT. Ear Scaffold Reconstruction Using Ultrasonic Aspirator for Cauliflower Ear. The Cleft Palate Craniofacial Journal. 2018;55(4):619–21.
https://doi.org/10.1177/1055665617732787
46. Noormohammadpour P, Rostami M, Nourian R, et al. Association Between Hearing Loss And Cauliflower Ear in Wrestlers, a Case Control Study Employing Hearing Tests. Asian J Sports Med. 2015;6(2):e25786.
https://doi.org/10.5812/asjsm.6(2)2015.25786
47. Özal N, Çetin Kara H, Çögen T, Özdoğan HA. Effect of External Ear Deformity on Hearing in Wrestlers. Am J Audiol. 2024;33(3):863-873.
https://doi.org/10.1044/2024_AJA-23-00277
48. Hirt Z, Stephen L, Liu J, Barnett J, Lee AH. Perception of cauliflower ear amongst combat sport athletes. Am J Otolaryngol. 2024;45(4):104293.
https://doi.org/10.1016/j.amjoto.2024.104293
49. Schuller DE, Dankle SK, Martin M, Strauss RH. Auricular injury and the use of headgear in wrestlers. Arch Otolaryngol Head Neck Surg. 1989;115(6):714-717.
https://doi.org/10.1001/archotol.1989.01860300068019