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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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THE OUTCOME OF PULSELESS PINK HAND FOLLOWING CLOSED SUPRACONDYLAR FRACTURE HUMERUS IN PEDIATRICS

Thamir F. Alkhiat[1]*, Abdulkareem Z. Al-Musawi[2], Mohammed Sanna Al-Shukoor[3], Adel Makki Alyasiri[4].

[1,2,3,4]*Department of surgery, Al-Sader Teaching Hospital, Basrah Medical college, University of Basrah, Iraq.*

Abstract.

Background: Management of children with supracondylar humeral fractures with pulseless pink hands is still controversial, whether to choose operative or conservative treatment. Proponents of conventional treatment mentioned that most patients can restore the motor and sensory function of the hand shortly after the injury without the need to restore distal pulse by surgery. Opponents of this treatment strategy claim that many patients will develop limb shortening a few years after the injury leading to functional and psychological problems. In this study, we made a comparison of the outcomes of each treatment to help in making policy for the treatment of such types of injuries in our center.

Results: This study answers the question "Which method is preferred for treating supracondylar humeral fracture with suspected vascular injury represented by pulseless pink hand, and what are the short and long-term outcomes of each treatment method.

Objective: "The main objective of the study is to settle a policy for the treatment of such types of injuries in our center.

Methods: This study is a retrospective for the 10-year period from 2010 to 2020, it included 74 patients with blunt trauma to one upper extremity. All patients were children aged one year to fourteen years. Patients with penetrating trauma, combined penetrating and blunt trauma, victims of burns and explosions, and patients with other co-morbidities were excluded. We have two treatment strategies: Conservative (watchful waiting) and Operative exploration. We compared the outcomes of these two strategies regarding the short-term outcome (6 months follow-up) and the long-term outcome (5 years follow-up). We looked for acute and chronic limb ischemia and chronic pain syndrome as the short-term follow-up, while we took limb shortening and chronic limb ischemia and limb function as variables of the long-term follow-up. We don't have the ability to control patients for the psychological examination by a psychiatrist, therefore; we excluded this variable from our study.

Key words. Supracondylar humerus fracture, vascular injury, Pink pulseless hand.

Introduction.

By managing this pathology at our facility, we discovered the following crucial issues. First and foremost, the majority of pediatric brachial artery accidents lack overt signs of ischemia. Thus, without performing extensive diagnostic examinations and urgent surgery equivalent to that done in situations involving adult vascular harm, it can be challenging to make a decision; nevertheless, these procedures can raise the risk of complications and use up unneeded medical and social resources [1,2]. In addition, it can be challenging to apply Doppler ultrasonography and computed tomography angiography (CT-A) in young patients, particularly those who have not yet enrolled in school [3-5]. To make certain that these techniques are secure and efficient, anesthesia is required. For a consequence, the time frame for assessment is extended, and the juvenile patient may experience anesthesia more than once during receiving therapy, which raises the possibility of anesthesia-related problems. Lastly, because the pediatric brachial artery has a tiny diameter, there is a risk that endothelial lesion destruction will result in actual blockage of the artery once the vessel wall has been opened for evaluation. If the lesion is lengthy, there is no alternate treatment using saphenous veins or artificial vessels, as there is in adults [6,7]. Additionally, brachial artery intervention in juvenile patients carries the risk of unfavorable outcomes such osteomyelitis, severe and destructive scarring, and vasotonic alterations. The long-term objective of this study is to reduce the length of treatment and prevent irrational medical resource use while ensuring that pediatric patients receive proper care for their wounds and prevent further vascular problems. In juvenile supracondylar humerus fractures, we sought to characterize the clinical and paraclinical features, the diagnostic strategy for brachial artery injuries, and to assess intraoperative vascular anatomic lesions and early and late postoperative outcomes [8,9].

Nevertheless, conservative management (close observation) is advised while the hand is warm and well-perfused because vascular exploration should only be done when the limb's circulatory status deteriorates. This is because collateral circulation of the elbow joint will provide enough blood supply for the limb. Patients who received CRPP for missing distal pulse due to misplaced SHFs experienced a respectable rate of palpable pulse recovery following surgery or achieved a pulseless but well-perfused limb. Without surgical exploration, positive results were obtained; no patients experienced compartment syndrome. Since the 1950s, SHFs have been treated with the classic conservative approach of close observation, which depends upon the collateral circulatory of the joint between the elbows [10-13].

According to studies, the damaged brachial artery can be strangled in order to preserve the limb. After SHFs, strong collateral circulation around the elbow has been seen using arteriography or ultrasonography. Additionally, there have, however, been few instances of employing color-flow duplex ultrasonography (CFDU) to evaluate collateral circulation status and brachial artery impairment prior to and during SHF surgery for the treatment [14].

Neurological problems related to supracondylar humeral fractures in children, on the other hand, are well established. According to reports, this fracture is connected with between 12 and 20 percent and two percent up to six percent, respectively, with traumatic and iatrogenic nerve damage. It is believed that

the radial and anterior interosseous nerves are more commonly affected by the fracture itself, but the ulnar nerve is most frequently damaged by iatrogenic causes. According to several studies, neurapraxias account for eighty-six to one hundred percent of these nerve injuries, and the average duration to recovery is between two and three months. Neurapraxias are usually cured on their own within six months [15,16].

Other reports, on the other hand, have mentioned insufficient healing and the necessity of surgical treatment in a few instances. The referral patterns and results of nerve injuries linked to humeral supracondylar fractures among children treated during a five-year period at a specialized peripheral nerve injury clinic [17].

Treatment strategy:

We studied the patients according to the treatment type that they received. Our initial policy of treatment is watchful waiting without surgical intervention unless hand ischemia becomes evident. It included all patients received from October 2010 to June 2014. A new policy was implemented after having an amputation of the hand of one patient due to ischemia and gangrene. The new policy was to explore every patient with a pulseless pink hand regardless of the presence or absence of ischemia and the CT angiography findings, if any. All patients had their fractures fixed promptly [18-20].

The aim of the study: In addition to assessing intraoperative vascular structural lesions and early and late postoperative outcomes, this study seeks to explain the clinical and paraclinical aspects of brachial artery injuries in pediatric supracondylar humerus fractures and the diagnostic approach to these injuries. Also, it aims to settle a policy for treating such cases in our center.

Clinical parameters:

The age of the patient (years), range of ages (one year to fourteen years old), sexual orientation (female/male), the side that was wounded in the upper part of the body (left/right), the way it happened of injury (high energy trauma/other), the kinds of bone fractures (closed fracture), the length of time (in hours) between the hospital's registration and the moment of arrival in the operating suite, and the clinical signs and symptoms.

Paraclinical parameters:

Short lesion, <5 millimeter/long lesion, 5 millimeters in CT-A for vascular damage. When conservative fracture treatment with casts failed, CT-A was recommended for patients with ischemia symptoms [21].

Treatment:

a. Conservative cast-based fracture therapy [22].

b. Treatment for vascular injuries includes brachial artery repair methods, brachial artery thrombectomy during surgery, and intraoperative vascular dilatation using papaverine [23].

c. Initial findings and a subsequent examination depended on a clinical evaluation and an elbow radiograph; handling consequences included bone dislocation and embolism [24].

Data Analysis:

Epidata 3.1 was used for entering categorized, cleaned, encoded data. Then, all statistical analyses were performed using software (SPSS, version 23.0). Preoperative, intraoperative, and postoperative parameters were summarized using descriptive statistics including frequency, percentage, mean, standard deviation, and interquartile range of values [25].

The Methods and Databases:

For the purpose of trying to find all patients under the age of 15 (between the ages of 1 and 14) who were initially addressed for additional management of vascular injuries correlated with a supracondylar fracture of the humerus, the collected database of our vascular surgical unit was reviewed over the course of a year, from May 1, 2022, to May 31, 2023.

The study was done retrospectively for ten years (2010-2020); children were taken from one year to the age of 14 years. Some children were treated conservatively (without surgical intervention), and this method was used in the first 5years of the study, as this was the center's policy. In the next five years, the referred children were treated surgically. The results were also studied for both treatment methods (short-term results - 6 months, including insufficiency of blood supply to the hand) and long-term results - 5 years, including chronic ischemia, upper extremity shortening, and hand functional problems [26-28].

Results.

A sample of kids aged under 15 years ages of one and fourteen who had suspected brachial artery injuries in conjunction with supracondylar humerus fractures between October 2010 and December 2020 were used in a retrospective, hospital-based investigation. The analysis comprised 74 patients in total. The mean age of the 74 pediatric patients was 7 years, and as much as 71% of them or 49 children were male. Gartland type III was assigned to 24 patients with badly displaced fractures prior to therapy. Resulting from casting, only 12% of patients had badly displaced fractures, whereas following percutaneous pinning, there were no patients with Gartland type III fractures.

Doppler sonography was not done for any patient either because of non-availability at the time of admission or because of non-compliance of patients because of associated pain or complex examination. More over one-third of the surgical patients—15 out of the 40—simply had vasospasm, not physical injury to the arterial wall or intravascular thrombosis. The degree of intraoperative brachial artery injury was not consistent with preoperative CT angiography. Of 19 patients in whom we found pulseless brachial artery with normal external arterial contour intra-operatively, 15 patients had only spasms. To consider cases of arterial spasm, we did arteriotomy. We used Fogarty's embolectomy catheter to ensure no intra-arterial thrombus, followed by intra-arterial irrigation with heparinized saline and papaverine. At the same time, four patients had intra-arterial thrombosis, which was proved by removing the thrombus using a Fogarty catheter. Ten patients with anatomical damage to the vascular wall underwent brachial artery repair; of these, five underwent direct repair for complete cuts and two for partial cuts, while three required the interposition of great saphenous vein grafts (one for long contusion and two for segment defects) to repair the artery. No early postoperative thrombosis happened, while late thrombosis was noted in 4 patients. Two out of every 40 patients experienced a temporary loss of sensation near the incision one month after surgery.

The mean duration between the start of the trauma and arrival at the first medical facility was 12 hours (interquartile range: 1-120 hours), and 52.8 hours was the mean time between the start of the trauma and arrival in the operating room (interquartile range: 4-168 hours). High-energy trauma was the most frequent cause of injuries (n = 49, 98%). Thirty-one patients (62.0%) sustained left arm injuries, whereas 19 (38.0%) sustained right arm injuries. The majority of patients (n = 46, 92%) have been identified as having Gartland type III fractures, whereas the remainder (n = 4, 8%) had Gartland type II fractures. In 60 patients with supracondylar fractures, the pink hand was present in 91% of cases, while the purple hand was seen in only 2% of cases (Table 1).

Therapeutic cases can be tracked in table number one as follows:

Patient No. 7, underwent an operation after two weeks of moderate to severe ischemia: at surgery a segment of the artery was contused, primary repair by a segment of GSV interposition graft Surgery was done in the form of bypass brachial to ulnar artery which restored pulse, and the hand color, No follow up for neurological function after discharge from the hospital.

Patient No. 8, the patient was presented to the specialty center after 2 days after the injury decision for amputation.

Patient No. 16, the patient was presented to the specialty center 2 days after the injury decision for amputation.

Patient No. 18, Nerve conduction study was done at 6 months and 5 years both are normal.

Patient No. 34, The decision for amputation because of severe pain (spastic hand- nonfunctioning).

Patient No. 35, 56, and 57 Finding: complete cut- direct repair.

Patient No. 36, 37, 38, 40, 47, 48, 49, 50, 54, 66, 67, and 71, Only spasm embolectomy.

Patient No. 68, thrombosis of short segment embolectomy.

Patient No. 39, 41, 42, 45, 53 , 57 , 69 and, 72, the interposition of the artery between bone segments release.

Patient No. 73, Totally normal artery- No action was done.

Patient No. 51, the repair of this patient was done using an interposition autogenous graft. It was noted to be thrombosed at the 6 months and 5 years of follow-up. The patient was asymptomatic, and the positive pulse was probably from a functioning palmar arch.

Patient No. 46, Muscle weakness in the distribution of the median nerve. This finding was noted at the time of the injury. At the time of exploration, the median nerve was cut partially and was repaired, Regarding the artery (total cut- primary repair).

Patient No. 52, Local thrombosis embolectomy

Patient No. 55, and 58, Partial injury direct repair.

Patient No. 56, The complete cut of the artery by 2 bone ends direct arterial repair

Patient No. 58, and 59, Long segment contusion, the injured segment was resected, and an interposition prosthetic graft was put in. Thrombosis happened to the graft after 6 months of follow-up. No action was taken as the limb was viable and the family refused further interventions.

Patient No. 69, Normal findings, No arterial injury.

Patient No. 73, Totally normal artery No action was done.

Patient No. 74, there was a total cut with segment loss at the time of initial surgery, repaired by interposition GSV graft. Successful repair. After that, the patient had two attacks of COVID-19 during the first 6 months of follow up which led to thrombosis of the graft. He was put on anticoagulation by Xarelto and no further surgery was done for him as he had a viable limb.

Discussion.

Clinical circumstances:

Pediatric supracondylar humerus fractures are more likely to cause non-dominant hand injuries. Males and females experience fractures at nearly similar rates. The majority of fractures among kids were in boys. 5-8 years old is the most typical age range.

Children at this stage of development are getting ready for or beginning education at schools, and while their awareness is still developing, they struggle to keep their motions and postures of their bodies under control. Despite this, they are eager to learn and explore the world around them. Sixty-two percent of kids suffered fractures in their left hand, which is less flexible and non-dominant than their right one. Because of the high-energy trauma, closed fractures occurred in every case. All patients were stable when they were taken to the hospital because the injuries are primarily caused by falling onto the hand, and the grounding distance was not too great [29,30].

According to the Gartland classification, type III fractures were present in 81% of patients. In supracondylar humerus fractures, where the artery is trapped in the fracture, it is consistent with injury to the brachial artery. Gartland type III dislocation was present in six out of eight individuals with supracondylar humerus fractures and vascular damage. The majority of the kids who were admitted to the hospital did not appear to have any ischemic symptoms. Only a few children (22%) and 2% of them had cyanosis, and none had ischemia, which is typical in adult limb vascular damage, or severe or irreparable limb hemorrhage. In the research we conducted, it took significantly longer than the recommended amount of time (6 hours after the accident) for persons with acute extremities ischemia to receive treatment for their condition in the operating room. Children's longer hospital stays and postponed surgeries may be caused by a number of factors. First off, their state is unaffected by the wounded hand's mild ischemia. Second, when performed on young children, diagnostic imaging methods like CT-Angiography take longer than they do on adults. The final treatment strategy for this injury is to reduce the fracture first; if the pulse returns, we will then continue with conservative treatment. Depending on the patient's condition and the health of the limb, we send the pulse for CT angiography or for surgical exploration if it is not restored [31-33].

Image Preoperative:

In this study, 74 supracondylar fracture cases were treated using a C-arm to guide percutaneous anchoring and bone relocation. There were 26 confirmed brachial artery damage cases, resulting in 7.48% of cases overall and 57.2% of cases

Table 1. *Clinical characteristics at admission.*

Patient No.	Sex	Age	Date of injury	Date of intervention	Short term follow up 6 months					Long term follow up 5 years			
					Acute ischemia (Pale viable hand)	Tissue Loss (Gangrene or ulcer)	Neurological injury	radial pulses	Early claudication	Late Claudication	Improper growth (shortening)	Limb function	radial pulses
1	Male	8	October 11th	No intervention	No	No	No	Negative	No	No	0.34 cm	Normal	Negative
2	Male	5	December 10th	No intervention	No	No	No	Negative	No	No	No shortening	Normal	Positive
3	Male	11	December 13th	No intervention	No	No	Mild parasthesia at the distribution of median nerve	Positive	No	No	No shortening	Normal	Positive
4	Female	3	January 1st	No intervention	No	No	No	Negative	No	Yes - at heavy exercise	0.78 cm	Normal at rest , affected by exercise	Negative
5	Female	12	January 11th	No intervention	No	No	No	Positive	No	No	No shortening	Normal	Positive
6	Male	5	January 16th	No intervention	No	No	No	Positive	No	No	No shortening	Normal	Positive
7	Male	13	February 22nd	No intervention	Yes	No	No	Negative	Yes	No	No shortening	Normal after intervention	Positive after intervention
8	Male	3	March 30th	No intervention	No	No	No	Negative	No	Yes - at moderate exercise	0.46 cm	Affected, especially power of handgrip, fine movement	Negative
9	Male	2	April 14th	No intervention	No	No	No	Negative	No	No	No shortening	Normal	Positive
10	Male	6	June 17th	No intervention	No	No	No	Negative	No	No	No shortening	Normal	Positive
11	Female	3	August 12th	No intervention	No	No	No	Negative	No	No	No shortening	Normal	Positive
12	Male	13	September 1st	No intervention	No	No	No	Negative	No	No	No shortening	Normal	Negative
13	Female	5	October 11th	No intervention	No	No	No	Negative	No	No	No shortening	Normal	Positive
14	Female	4	November 30th	No intervention	No	No	No	Negative	No	No	No shortening	Normal	Positive
15	Male	10	February 1st	No intervention	No	No	Parasthesia at the distributuion of radial nerve - simple	Positive	No	No	No shortening	Normal	Positive
16	Male	14	March 16th	No intervention	Yes- Acute severe delayed	Developed after 24 hours	Paralysis	Negative	None				
17	Male	5	April 22nd	No intervention	No	No	No	Positive	No	No	No shortening	Normal	Positive
18	Female	9	June 6th	No intervention	No	No	Parasthesia at the distribution of median nerve	Negative	Yes at heavy exercises	Much improved	0.6 cm	Affected especially the fine movement of the hand - nerve conduction study was noemal	Negative
20	Male	7	August 11th	No intervention	No	No	No	Positive	No	No	No shortening	Normal	Positive
21	Male	3	October 11th	No intervention	No	No	No	Positive	No	No	No shortening	Normal	Positive
22	Male	5	November 20th	No intervention	No	No	No	Positive	No	No	No shortening	Normal	Positive
23	Female	5	January 5th	No intervention	No	No	No	Positive	No	No	No shortening	Normal	Positive

24	Female	10	February 18th	No intervention	No	No	No	Negative	No	No	No shortening	Normal	Positive
25	Male	4	March 13th	No intervention	No	No	No	Positive	No	No	No shortening	Normal	Positive
26	Male	2	May 8th	No intervention	No	No	No	Positive	No	No	No shortening	Normal	Positive
27	Female	12	July 11th	No intervention	No	No	Parasthesia over the hand	Negative	Yes	Yes	No shortening	Muscle wasting , fine movements like thumb movements are weak	Negative
28	Male	2	August 29th	No intervention	No	No	No	Positive	No	No	No shortening	Normal	Positive
29	Female	6	September 18th	No intervention	No	No	No	Negative	No	No	No shortening	Normal	Positive
30	Female	3	December 1st	No intervention	No	No	No	Positive	No	No	No shortening	Normal	Positive
31	Male	13	December 25th	No intervention	No	No	No	Negative	No	No	No shortening	Normal	Negative
32	Female	5	January 17th	No intervention	No	No	No	Positive	No	No	No shortening	Normal	Positive
33	Female	4	February 22nd	No intervention	No	No	No	Negative	No	No	No shortening	Normal	Positive
34	Male	10	March 15th	No intervention	No	No	No	Negative	No	Yes- Limb was non functional - wasted	0.7cm	Non functional limb	Negative
Interventions													
Patient No.	Sex	Age	Date of injury	Date of intervention	Short term follow up 6 months					Long term follow up 5 years			
					Limb ischemia (Pale viable hand)	Tissue Loss (Gangrene or ulcer)	Neurological injury	radial pulses	Early claudication	Late Claudication	Improper growth (shortening)	Limb function	radial pulses
35	Male	4	June 16th	jun 16th	No	No	No	Positive	No	No	No shortening	Normal	positive
36	Male	11	August 22th	August 22th	No	No	No	Positive	No	No	No shortening	Normal	positive
37	Male	2	November 12th	November 22th	No	No	No	Positive	No	No	No shortening	Normal	positive
38	Female	5	January 1st	January 1st	No	No	No	Positive	No	No	No shortening	Normal	positive
39	Male	5	January 17th	January 17th	No	No	No	Positive	No	No	No shortening	Normal	positive
40	Female	7	February 22nd	February 25th	No	No	Parasthesia	Positive	No	No	No shortening	Normal	positive
41	Male	3	April 14th	April 4th	No	No	No	Positive	No	No	No shortening	Normal	positive
42	Male	3	May 1st	May 29th	No	No	No	Positive	No	No	No shortening	Normal	positive
43	Male	9	July 19th	July 17th	No	No	No	Positive	No	No	No shortening	Normal	positive
44	Male	12	September 22nd	September 23th	No	No	No	Positive	No	No	No shortening	Normal	positive
45	Male	14	October 1st	October 11th	No	No	No	Positive	No	No	No shortening	Normal	positive
46	Female	5	November 2nd	November 13th	No	No	Muscle weakness in the distribution of median nerve. This finding was noted at the time of injury.	Positive	No	No	No shortening	Opposition and other fine movements of the hand were affected to a lesser degree than the 6-months follow up. Physiotherapy was partially beneficial	positive

47	Female	1	December 27th	December 27th	No	No	No	Positive	No	No	No short-ening	Normal	positive
48	Male	5	January 09th	January 9th	No	No	No	Positive	No	No	No short-ening	Normal	positive
49	Male	4	February 20th	February 20th	No	No	No	Positive	No	No	No short-ening	Normal	positive
50	Male	6	March 3rd	March 3rd	No	No	No	Positive	No	No	No short-ening	Normal	positive
51	Male	8	March 1st	March 3rd	No	No	No	Nega-tive	No	No	No short-ening	Normal	positive
52	Female	6	May 1st	May 5th	No	No	No	Positive	No	No	No short-ening	Normal	positive
53	Male	10	jun 1st	Jun 2nd	No	No	No	Positive	No	No	No short-ening	Normal	positive
54	Male	4	August 1st	August 2nd	No	No	No	Positive	No	No	No short-ening	Normal	positive
55	Female	3	October 1st	October 11th	No	No	No	Positive	No	No	No short-ening	Normal	positive
56	Female	6	December 13th	December 13th	No	No	Parasthesia	Positive	No	No	No short-ening	Normal	positive
57	Male	9	March 10th	March 13th	No	No	No	Positive	No	No	No short-ening	Normal	positive
58	Male	4	April 4th	April 10th	No	No	No	Positive	No	No	No short-ening	Normal	positive
59	Male	5	May 1st	March 5th	No	No	No	Nega-tive	No	No	Shortening of 0.3 cm	Impaired fine movements	Negative
60	Female	13	July 21st	July 1st	No	No	No	Positive	No	No	No short-ening	Normal	positive
61	Male	8	August 31th	August 31th	No	No	No	Positive	No	No	No short-ening	Normal	positive
62	Male	2	october 11th	November 4th	No	No	No	Positive	No	No	No short-ening	Normal	positive
63	Female	4	January 10th	January 1st	No	No	No	Positive	No	No	No short-ening	Normal	positive
64	Female	3	February 5th	February 6th	No	No	No	Positive	No	No	No short-ening	Normal	positive
65	Male	4	April 17th	April 17th	No	No	No	Positive	No				
66	Male	11	May 25th	May 27th	No	No	No	Positive	No				
67	Male	2	july 1st	july 7th	No	No	No	Positive	No				
68	Female	5	September 11th	September 11th	No	No	No	Positive	No				
69	Male	5	February 2nd	February 2nd	No	No	No	Positive	No				
70	Female	7	May 1st	May 5th	Yes	No	Parasthesia, mild pain	Nega-tive	No				
71	Male	3	August 13th	August 15th	No	No	No	Positive	No				
72	Male	3	November 19th	November 19th	No	No	No	Positive	No				
73	Male	9	January 22nd	January 22nd	No	No	No	Positive	No				
74	Male	12	June 16th	August 2th	No	No	No	Nega-tive	Yes, claudi-cation only in strenous exercises as swimming and heavy overhead lifting				

with sequelae since the clinical symptoms and signs of ischemia in young children, especially those who are not yet in school, are vague and challenging to identify [34].

When choosing between surgical and non-surgical procedures, imaging for diagnostic purposes is crucial. The majority of youngsters are school-aged, have a weak or absent sense of collaboration, and require complex, high-quality vascular imaging diagnostic procedures [35].

Vascular diagnostic tests must be performed under anesthesia, which makes it challenging to allocate personnel and equipment and increases the chance of unfavorable outcomes.

Most Doppler ultrasound investigations are unable to accurately evaluate the blood vessels at the fracture level, including the vessel wall and lumen, because they are conducted in emergencies without consent from patients, casts, edema, and hematoma. To confirm the diagnosis of upper extremity vascular damage, that information is required. In our study, a CT-Angiography of the upper extremity is performed on more than half of the pediatric patients. The upper extremity's whole circulatory system can be evaluated for perfusion status using CT-Angiography, however it is not accurate for determining the extent of damage to the artery wall and lumen in young patients. We discovered that not all subjects with brachial artery lesions on CT-A less than 5 mm in length required surgery. All of the study subjects who had lesions longer than 5 mm were advised to have surgery, however only half of them were able to identify the vascular lesion during the procedure. Hence, CT-Angiography might be particularly useful for patients with short lesions (less than 5 mm) (Figures 1 and 2) and other patients (Figures 3 and 4) in deciding on conservative therapy [36,37].

Vascular Rehabilitation's Post-Treatment Efficacy

Treatment for traditional closed supracondylar humerus fractures involves relocating the broken bone and either casting or pinning. The well-born reposition may allow for blood vessel decompression and blood flow restoration in cases of vascular damage. In cases where there is actual anatomical damage to the arterial wall, surgical treatment is still required to address the vascular injury, even with flawless born relocation. The most successful procedure for attaining and sustaining bone repositioning is pinning. Casts, on the other hand, offer the easiest and least invasive treatment; although they may not provide perfect shifting positions, they may be able to decompress veins and restore blood flow. Prior to treatment, the majority of patients in the current research (81%) had type III displaced supracondylar humerus fractures; however, following casting, this percentage dropped considerably to 12%, and after pinning, to 0% [38].

Figure 1. *Brachial artery injuries in multislice CT-A, (Lesions < 5 mm).*

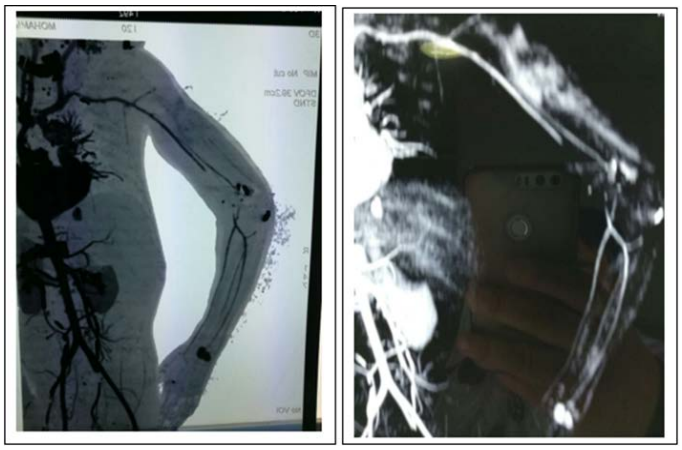

Figure 2. *Brachial artery injuries in multislice CT-A,(Lesions ≥ 5 mm).*

Figure 3. *Brachial artery injuries in multislice CT-A, (Lesions < 5 mm) for another patient.*

Figure 4. *Brachial artery injuries in multislice CT-A,(Lesions ≥ 5 mm), for another patient.*

Surgical Direction:

Concerning the instances of conservative therapy where the cast was put on after the bone was realigned. Patients were being monitored for evidence of hand ischemia up to June 2014, but after that date, they were transported for surgical investigation and fracture relocation, pinning, and revascularization because the radial pulse had not yet been discovered [39].

More than one-third of surgical cases were discovered to have vasospasm intraoperatively, without vascular thrombosis or morphological damage to the arterial wall. After fracture relocation and casting, the blood vessels have typically been freed from the fracture and only a small number are still lodged there. Fractures were repaired in every case of surgical exploration by pinning with K-wire from the lateral side. Vasospasm was treated using arteriotomy and a Fogarty catheter to ensure there was no intravascular thrombus, whereas actual vascular injury required direct brachial artery repair or the use of a donor. The artery only required to be released in situations where it was discovered to be situated between the two ends of a fracture. There have been few instances of brief spasms associated with vasospasm, which subside after fracture reduction. It mildly restores the flow of blood without endangering the artery wall or causing lumen thrombosis. This explains how a multislice CT-Angiography can reveal the loss of a brachial artery section but not the vessel wall being harmed during operation. Thus, surgery won't likely be necessary if Doppler ultrasound precisely determines the status of a contusion in the transverse fracture and non-thrombotic lumen. When a vascular surgery specialist is not accessible, it results in avoiding vascular surgery and the danger of major vascular complications [40].

Limitations.

This article has a few restrictions that should be mentioned. First, some patients were excluded from the study because of insufficient data. Secondly, Doppler ultrasound is not available for most afternoon and night cases, in addition to the lack of experience in trauma cases. Therefore, it is not done for most patients. Lastly, perfect closed reduction is not achieved in many cases. Therefore some cases were operated on depending on negative pulses after such reduction. It might explain the high percentage of arterial spasms intraoperative.

Conclusion.

The majority of pediatric patients were not initially showing lower extremity vascular injuries-related symptoms of critical limb ischemia. In this study, pediatric supracondylar humerus fractures with vascular injuries were diagnosed and treated retrospectively using medical records at Basrah's XXX Teaching Hospital, one of the city's oldest and largest surgical public hospitals, between the month of May 2022 and the month of May 2023. In this study, we looked at information on patients who were treated at our hospital for traumatic arterial injury to the upper extremities and were between the ages of 1 and 14. Radiographs with supracondylar humerus fractures and loss of the ulnar/radial pulse were required for the diagnosis of brachial artery damage in conjunction with supracondylar humerus fractures. Patients who had previously had elbow fractures that resulted in restricted motion and deformity were not included in the study. We concluded that surgical exploration is recommended for patients with pulseless pink hands and supracondylar humerus fracture if the pulse is not restored after closed reduction. CT angiography will delay the surgical intervention if needed, is costly, needs sedation or general anesthesia in some patients, and sometimes fail to differentiate spasm and actual vascular injury. That's why we plan to avoid it, except for particular cases. So, exploring for adverse injury is better than waiting for limbs to be nonfunctional or ischemic.

Authors Contributions:

Conceptualization, Thamir Fozzie Muhmood; methodology, Adel Makki Abdulateef and Abdulkareem Z. Al-Mussawi; validation, Abdulkareem Z. Al-Musawi, and Mohammed Sanaa Alshukoor formal analysis, Mohammed Sanaa Alshukoor and Adel Makki Abdulateef; investigation, Thamir Fozzie Muhmood, Adel Makki Abdulateef, Abdulkareem Z. Al-Musawi, and Mohammed Sanaa Alshukoor; data curation, Thamir Fozzie Muhmood, and Mohammed Sanaa Alshukoor finalize the manuscript in the last version.

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Statement Regarding Informed Consent: Each individual participant in the study gave their informed consent. If the participants are under 18 or are otherwise unable to give written informed permission due to a legal or physical condition, consent was sought from their parents or legal guardians.

Data Availability Statement: Upon reasonable request, the corresponding author will provide all the data that support this study's conclusions. Please contact Dr. Thamir F. Alkhiat with requests for access to this data (e-mail: thumir.muhmood@uobasrah.edu.iq).

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