Diploma thesis

Sternoclavicular abscess: Prognostic factors of a rare, life-threatening disease.

Submitted by

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Vorwort

Für das Thema dieser Diplomarbeit kontaktierte ich im Sommer 2015 Frau Prof.in Smolle-Jüttner an der Medizinischen Universität Graz. Das Interesse für die Thoraxchirurgie wurde bei mir circa ein Jahr davor geweckt, als ich in Linz im Krankenhaus der Elisabethinen famulierte. Daraufhin entschied ich mich meine Abschlussarbeit in einem Bereich zu schreiben, der mich besonders fasziniert und Frau Prof.in Smolle-Jüttner konnte mir ein sehr interessantes Thema anbieten, von dem ich bis dato noch nicht wirklich viel gehört hatte. Die bisher geringe Datenlage dieses Krankheitsbildes motivierte mich umso mehr, die Patientendaten des LKH auszuwerten und Unterschiede und Gemeinsamkeiten herauszufinden.

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Abstract

Sternoclavicular septic arthritis with formation of abscesses is a very rare life-threatening disease, making up for only 1 % of cases of septic arthritis. Usually this condition affects patients with accompanying diseases. In most cases repeated debridement and subsequent reconstruction using pedicled muscle flaps is necessary, often resulting in a prolonged course of disease.

The aim of this retrospective study was to find factors allowing to estimate prognosis.

We analysed 18 cases of sternoclavicular septic arthritis treated between 2005 and 2015 at the Division of Thoracic and Hyperbaric Surgery in Graz. There were 7 male and 11 female patients (mean age: 69 years; range: 41-88); An average of 5 surgical interventions (range: 1-12) was necessary, including pedicled muscle flaps in 10 cases. The mean duration of stay at the Intensive Care Unit of was 7 days (range: 0-40 days) and the mean total duration of inpatient care was 26 days (range: 10-86 days). Obviously, the need for many operations was statistically significant connected with a longer stay. All patients survived.

Though there was a wide range of comorbidities (diabetes mellitus: N=7; chronic renal failure: N=2; hepatic cirrhosis: N=3; preexisting infection at other site: N=7), none of them affected prognosis nor did any of the pathological laboratory findings at the time of admission (CRP, leucocytes, albumin, renal or hepatic markers) or gender. The only factor statistically significant correlated with a long in-hospital stay ($p<0.05$) was higher age, which was also connected with a significantly higher probability for the need for pedicled muscle flaps.

In conclusion, the significant co-mobidity usually found in patients with sternoclavicular septic arthritis has no impact on the healing process, which seems to be influenced mainly by the patients age.

Zusammenfassung

Sternoclaviculare Abszesse sind meist mit einem schweren, oft lebensbedrohenden septischen Zustandsbild verbunden. Mit nur 1% aller septischen Arthritiden stellen sie ein sehr seltenes Krankheitsbild dar, von dem meist multimorbide Patienten betroffen sind. In den meisten Fällen sternoclavicularer Abscesse sind wiederholte Debridements und Rekonstruktion, häufig unter Verwendung von Muskellappen erforderlich.

Ziel dieser retrospektiven Analyse war Faktoren herauszufinden, die eine Abschätzung des Krankheitsverlaufs erlauben.

Wir untersuchten 18 Fälle von Sternoclavicularabszess mit Sepsis, die zwischen 2005 und 2015 an der Klinischen Abteilung Thorax- und Hyperbarchirurgie behandelt worden waren. Das Kollektiv umfasste 7 Männer und 11 Frauen. Das Durchschnittsalter betrug 69 Jahre (41 – 88 Jahre). Im Mittel waren 5 chirurgische Eingriffe (1 bis 12) erforderlich, die in 10 Fällen auch Defektverschluss durch gestielte Muskellappen umfassten. Die durchschnittliche Aufenthaltsdauer an der Intensivstation betrug 7 Tage (0 – 40 Tage), der mittlere gesamte Aufenthalt 26 Tage (10 bis 86). Das Erfordernis multipler Eingriffe war signifikant mit längerer Aufenthaltsdauer verbunden. Alle Patienten überlebten.

Trotz eines breiten Spektrums an Begleiterkrankungen (Diabetes mellitus: N=7; Niereninsuffizienz: N=2; Cirrhosis hepatis: N=3; vorbestehender Infekt anderer Lokalisation: N=7) hatte keine davon statistisch signifikanten Einfluss auf die Prognose. Auch die Laborwerte zum Zeitpunkt der Aufnahme (CRP, Leucocyten, Albumin, renale bzw. hepatische Parameter) hatten ebensowenig Einfluss wie das Geschlecht. Der einzige statistisch signifikant ($p<0.05$) mit längerer Hospitalisierungszeit verbundene Faktor war das Alter. Ältere Patienten hatten auch höhere Wahrscheinlichkeit für das Erfordernis von Muskelflaps zur Defektdeckung.

Zusammenfassend hat die deutliche Comorbidität von Patienten mit sternoclavicularen Abszessen keinen Einfluss auf den Heilungsprozess, der offenbar vornehmlich durch das Alter der Patienten bestimmt wird.

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List of abbreviations

MRSA ..... Methicillin resistant Staphylococcus Aureus
SJI ..... Sternoclavicular joint infection
VAC ..... Vacuum assisted closure
CRP ..... C-reactive protein
GGT ..... Gamma-Glutamyl transpeptidase
CHE ..... Cholinesterase
CT ..... Computed tomography
MRI ..... Magnetic resonance imaging
IVDA ..... Intravenous drug abuse
ICU ..... Intensive care unit
A ..... Arteria
V ..... Vena

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1 Introduction

Sternoclavicular joint infection (SJI) is a rare condition, which can be associated with serious complications such as chest wall abscess, osteomyelitis, pleural involvement, mediastinitis and severe sepsis (1–4). Only in 1% of septic arthritis cases the sternoclavicular joint is affected. Misdiagnoses are frequent (1, 2). Even in large studies (1) the SJI is considered as and unusual localisation of septic arthritis in both otherwise healthy individuals and patients with concomitant diseases. The treatment options include conservative management by antibiotic therapy but may often require radical excision of the joint including muscle flap reconstruction (1, 4).

Better technology in imaging and major improvement in targeted antibiotic medication over the last decades have led to more specific management of this rare disease (1).

We reviewed 18 cases of sternoclavicular septic arthritis treated at the Division of Thoracic and Hyperbaric Surgery within the past 20 years trying to find factors that might influence the clinical course.

1.1 Osteomyelitis

Acute and secondary chronic osteomyelitis is usually affecting the long bones and the spine. Sternoclavicular osteomyelitis which involves the sternal part of the clavicle and the manubrium and may even extend to the first rib is a comparatively rare finding.

In most instances, acute osteomyelitis develops as sequelae of general infection / sepsis with bacteraemia. It can spread into joints (septic arthritis) and soft tissue. Men have a higher risk to develop osteomyelitis than women.

Pain and functional impairment of the affected structures are the main symptoms. If the joint is infected, a collateral joint effusion will develop.

In many cases of osteomyelitis, no real “starting point” of the infection can be determined and due to initially vague clinical signs the diagnosis can be difficult. In adults the symptoms are usually less distinct compared to osteomyelitis found in children.

To confirm the diagnosis osteomyelitis, X-ray, computed tomography and magnetic resonance imaging are used. Spotted brightening, periosteal changes and osseous sequester can be found.

Osteomyelitis – its localisation notwithstanding – is treated by a number of defined measures which involve targeted antibiotic treatment and immobilisation of the afflicted regions. The poor vascularisation of sclerotic bone and necrotic tissues, however, does not always allow for adequate levels of antibiotics in the target region. Therefore, surgical treatment is required in such cases. Excision of necrotic tissue and removal of debris can save the surrounding structures from secondary involvement and can prevent recurrences (14, 15).

1.2 Anatomy of the sternoclavicular joint

The sternoclavicular joint is localised between the proximal end of the clavicle and the clavicular notch of the manubrium sterni. It is a so-called diarthrotic joint.

A small part of the first costal cartilage is also in contact with the joint (Figure 1). The saddle-shaped articular cavity is seperated into two compartments by a 3-5mm thick fibrous articular disc. Fibrous cartilage also is forming the articular surfaces (16).

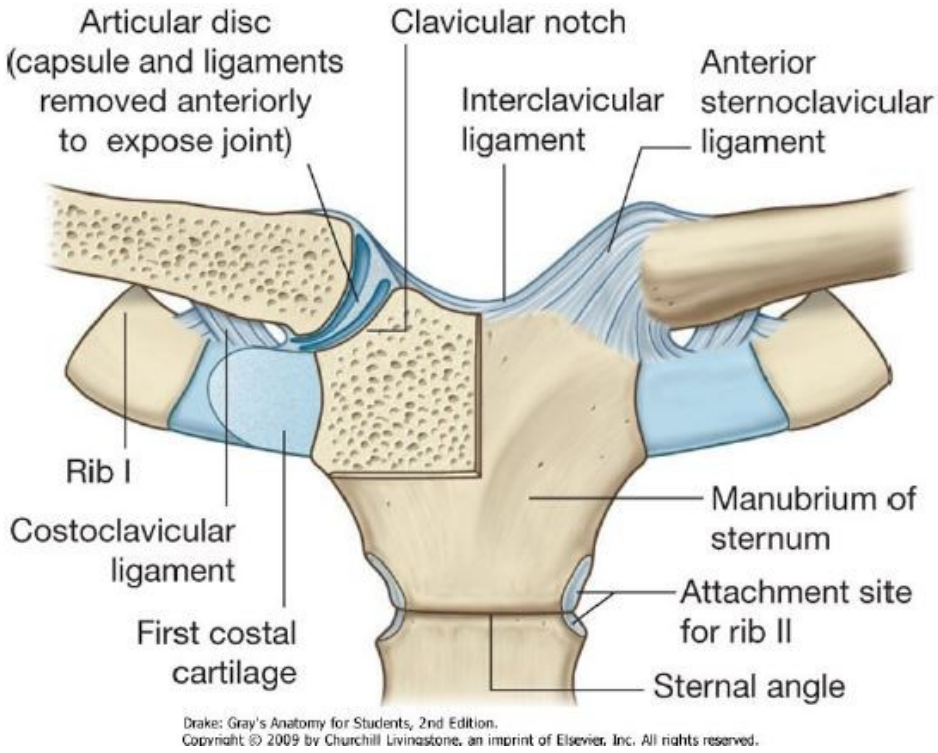

Figure 1 Sternoclavicular joint

The osseous and chondral structures forming the joint are connected by a number of tight fibrous structures: They are called anterior sternoclavicular, posterior sternoclavicular, costoclavicular and interclavicular ligament.
Both the anterior and posterior sternoclavicular ligaments additionally reinforce the loose and thick articular capsule.

The sternoclavicular joint allows for movements of the clavicle in the anteroposterior and vertical planes, and even for some rotation (16). Movements of the shoulder and the upper arm are invariably connected with movements in the sternoclavicular joint.

1.2.1 Structures adjacent to the sternoclavicular joint

In close proximity to the sternoclavicular joint are structures which must be indispensably taken care of. Most important during surgical interventions are the veins and arteries: A. / V. subclavia, A. / V. thoracica interna and the brachiocephalic vessels.

1.3 Septic arthritis of the sternoclavicular joint

The infected joint can show with different degrees of inflammation and consecutive destruction ranging from mere edema and hyperemia to chondro-osteolytic damage of the joint itself, and to involvement of the adjoining structures: Inflammation and abscess in the pectoralis muscles is often present. Though uncommon in septic arthritis of other joints osteomyelitis, both involving the clavicle or the sternum, is a common finding (→3.1). In severe cases the inflammatory process can spread into the pleural cavity, causing pleural effusion or empyema.

2 Material and methods

We analysed 18 cases of sternoclavicular septic arthritis treated between 2005 and 2015 at the Division of Thoracic and Hyperbaric Surgery in Graz.
The patients were identified by using the open-MEDOCS system.
Cases were accepted if they were coded with ICD 10 I02.2 or M86.99, which indicates positive cultures of aspirates, drainage or specimens from the joint and imaging that supports the diagnosis. 18 patients met these criteria.

2.1 Statistical Analysis

As descriptive statistics, mean, standard deviation and range were calculated for metric variables, and absolute and relative frequencies for ordinal variables. Correlation between various metric variables was calculated by Spearman's rank correlation test, and the difference between laboratory values at time of admission and time of discharge were evaluated by t-test for paired values.

3 Results

3.1 Epidemiology and clinical findings

The mean age of the 18 patients was 69 years (range: 41-88 years). Seven patients with SJI were male, 11 female. All cases presented with acute disease involving fever, local erythema and swelling accompanied by distinct pain that was aggravated by movements of the respective upper arm or shoulder.

The side of the infection had no association with right- or left-handedness of the patients, as 10 infections were located at the right and 8 on the left side in 18 right-handed individuals.

3.2 Laboratory findings, Radiological findings

All patients had elevated CRP at their admission (mean: 184,9 mg/l; range: 2,1-438,8 mg/l) and serum leucocytosis was found in 12 of 18 (mean: 16,2 G/l; range: 5,8-32,0 G/l). Further laboratory changes are listed in Table 1. With the exception of hepatic Cholinesterase (CHE) which declined to in part drastically subnormal values, the laboratory findings had more or less normalized at the time of discharge (→Table 1).

Laboratory data	Minimum	Maximum	Mean Value	Standard Deviation
CRP (admission) [mg/l]	2,1	438,8	184,9	131,3
CRP (discharge) [mg/l]	1,5	235,0	65,8	64,0
Leukocytes (admission) [G/l]	5,8	32,0	16,2	8,0
Leukocytes (discharge) [G/l]	4,7	13,4	7,7	2,3
Albumin (admission) [g/dl]	1,9	4,4	2,8	0,7
Albumin (discharge) [g/dl]	1,7	4,0	3,1	0,6
Creatinin (admission) [mg/dl]	0,4	4,3	1,3	1,0
Creatinin	0,3	1,4	0,8	0,3

(discharge) [mg/dl]				
GGT (admission) [U/l]	16,0	443,0	131,4	105,5
GGT (discharge) [U/l]	16,0	196,0	89,6	53,4
CHE (admission) [U/l]	1839,0	8828,0	4569,6	2620,9
CHE (discharge) [U/l]	549,0	7696,0	4139,5	2160,1
Glucose (admission) [mg/dl]	82,0	589,7	156,3	118,9
Glucose (discharge) [mg/dl]	66,0	251,0	119,1	48,7

Table 1 Laboratory data

Computed tomography scan (CT) was performed in 17 out of the 18 patients. In all these cases pathological findings were documented by marked soft-tissue edema, distension of the articular cavity and destruction of bone due to osteomyelitis, as shown in Figure 2 and Figure 3. In 3 other cases intrapleural involvement or chest wall abscess was additionally found.

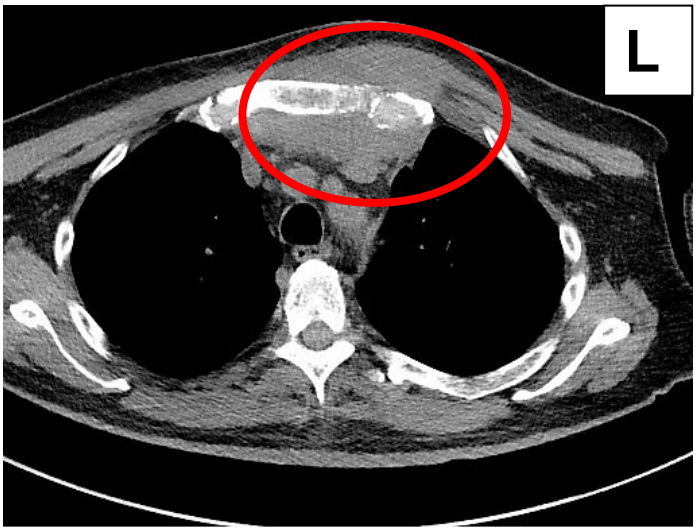

Figure 2 Sternoclavicular joint abscess left side (male patient)

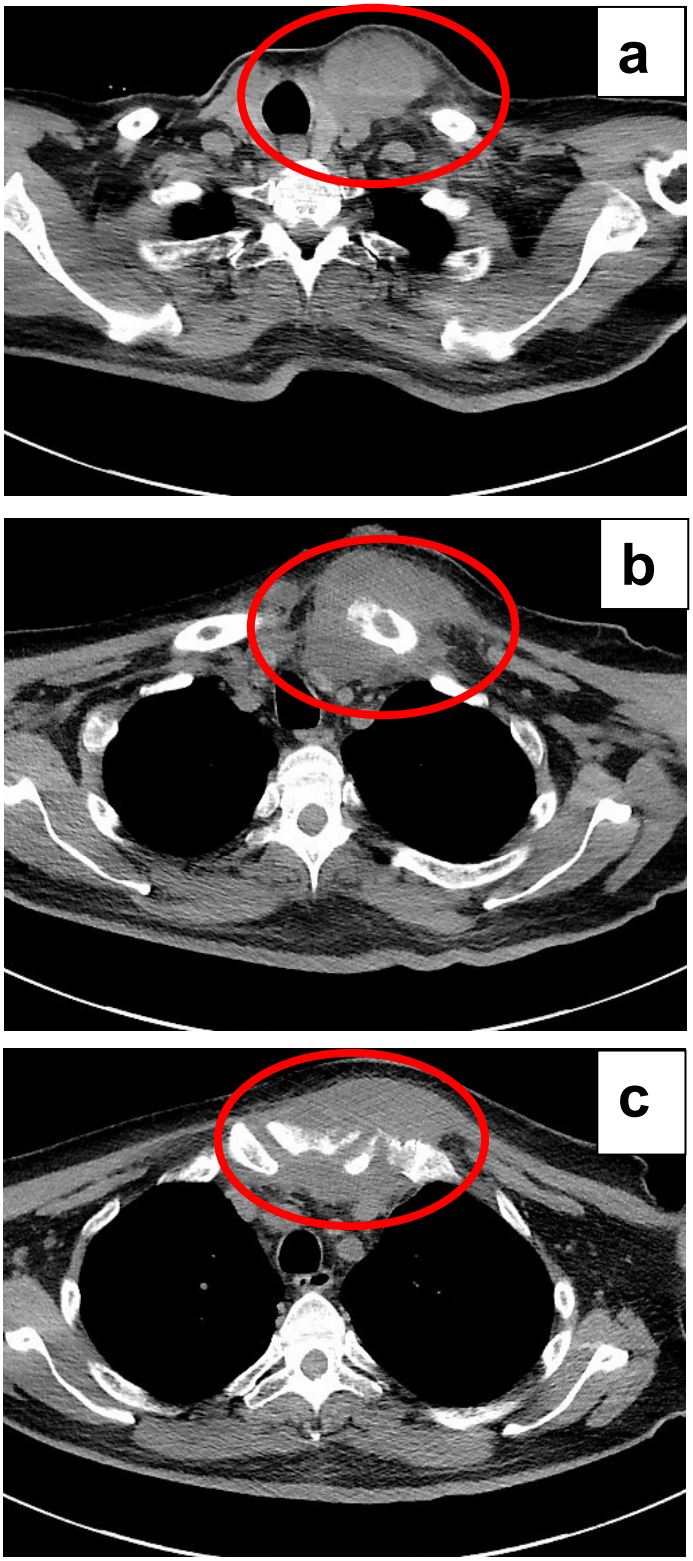

Figure 3 Left sternoclavicular joint abscess. a: soft tissue edema and abscess; b: Inflammatory destruction at the sternal end of the clavicula; c: Distension of the sternoclavicular joint, destruction of both sternal end of clavicula and manubrium sterni, marked soft-tissue inflammation.

In 15 out of the 17 surgically treated patients the microbiological swabs revealed causative microorganisms (→Table 2). In two patients no bacteria could be detected. One patient had been treated conservatively wherefore no swabs had been taken.

The majority of positive microbiological specimens contained Staphylococcus aureus (9 of 17), four further abscesses were caused by Staphylococci of other subtypes. Only in four instances microorganisms other than Staphylococci were present.

Bacteria	Number of positive specimens
Staphylococcus aureus	9
Staphylococcus schleiferi	1
Propionibacterium acnis	1
Enterococcus faecalis	1
Staphylococcus epidermidis	2
Staphylococcus haemolyticus	1
Streptococcus pneumoniae	1
Escherichia coli	1

Table 2 Microbiological findings

3.3 Risk Factors

The main predisposing condition for an inflammatory process of the sternoclavicular joint was diabetes mellitus (7 patients). Three patients had a malignant disease in history, 3 had hepatitis and / or cirrhosis and 2 presented with chronic renal failure. One patient had a history of intravenous drug abuse (see Table 3).

Infections at various locations seem to have the potential to cause a sternoclavicular abscess by hematogenous spread. In the present collective there were infections of the perianal region (N=1 patient), multiple abscesses in the lower extremity (N=4 patients), osteomyelitis of phalanges (N=1 patient), septic gonarthritits (N=1 patient), and one dental focus (N=1 patient).

Predisposing Conditions	Number of patients
Intravenous drug abuse (IVDA)	1
Diabetes mellitus	7
Chronic renal failure	2
Malignant disease in history	3
Hepatitis/cirrhosis	3
Pre-existing infection	7

Table 3 Predisposing conditions

Patient	Age (at first intervention)	Age from 0-30 [at first intervention]	Age from 31-50 [at first intervention]	Age from 51-70 [at first intervention]	Age from 71-95 [at first intervention]	Male	Female	Surgical interventions concerning the SCJ (incl VAC)	Time on Critical Care Unit [days]	Whole duration of stay at thoracic surgery [days]	Intrapleural involvement	Clavicular and/or sternal osteomyelitis	Muscle flap used
1	72	0	0	0	1	0	1	5	10	45	0	1	1
2	78	0	0	0	1	0	1	7	11	16	0	1	0
3	70	0	0	1	0	0	1	9	9	19	0	1	1
4	67	0	0	1	0	1	0	6	6	15	0	1	0
5	73	0	0	0	1	1	0	12	40	40	1	1	0
6	75	0	0	0	1	1	0	3	0	25	0	1	1
7	66	0	0	1	0	0	1	4	0	15	0	1	0
8	49	0	1	0	0	1	0	0	0	15	treated conservatively		
9	88	0	0	0	1	0	1	4	5	25	1	1	1
10	81	0	0	0	1	0	1	9	13	86	1	1	1
11	66	0	0	1	0	0	1	4	0	27	0	1	1
12	87	0	0	0	1	0	1	3	8	10	0	1	1
13	59	0	0	1	0	1	0	1	0	12	0	1	0
14	41	0	1	0	0	0	1	3	4	16	0	1	0
15	69	0	0	1	0	1	0	8	1	27	0	1	1
16	49	0	1	0	0	0	1	6	0	33	0	1	0
17	64	0	0	1	0	1	0	6	5	18	0	1	1
18	86	0	0	0	1	0	1	6	9	28	0	1	1

Table 4 Age distribution and intervention associated findings

3.4 Prognostic Factors

Concerning the 18 patients in this study, several correlations have been found that might be helpful in estimation of the duration of the clinical course. Male patients had significantly higher levels of creatinine and glucose at time of admission (p=0,05), the presence or absence of diabetes mellitus notwithstanding. Time on intensive care unit correlated directly to the patients age (p=0,01). The older the patients were, the longer they had to stay at the intensive care unit (ICU) and the more likely they needed follow-up treatment. Also, the more surgical interventions a patient had, the longer he/she had to stay at the intensive care unit (p=0,05).

Age was also significantly correlated to the requirement of muscle flaps for wound closure (p=0,05).

Obviously, the duration of in-hospital treatment was directly connected to the number of necessary surgical interventions (p=0,05), which was the only direct correllation we could find for the duration of stay.
On the other hand, neither the presence of cirrhosis nor of chronic renal failure or diabetes had a negative impact on the clinical course. Also none of the laboratory parameters had a predictive value for the duration of hospital stay.

Furthermore, owing to the fact that only one patient had a history of IVDA, no correllation to the outcome could be found for intravenous drug abuse.

3.5 Treatment and Outcome

17 out of the 18 patients (94%) were surgically treated whereas intravenous antibiotic therapy alone was sufficient in one case.

The mean stay at the Intensive Care Unit of a SJI patient was 7 days (range: 0-40 days) and the mean total duration of inpatient care was 26 days (range: 10-86 days).

3.5.1 Surgical treatment

Surgery was performed in 17 of 18 patients. In all of these, debridement of the abscess and its surroundings as well as resection of the clavicular/sternal bone to varying extent was necessary. After the initial procedure the resulting

cavity was treated by vacuum-assisted-closure (VAC) until clean granulation tissue had developed. In 10 out of the 17 surgically treated patients the size of the resulting defect could not be covered directly but needed closure by a pedicled muscular flap taken from the major pectoralis muscle (Figure 4 and Figure 5). Pleural involvement was found in 3 patients and treated by insertion of a chest-tube drainage in two cases, while in one pleural debridement over anterior mini-thoracotomy was necessary.

An average of 5 procedures per patient (range: 1-12 surgical interventions) including application and changes of vacuum assisted closures (VAC) and reconstruction was required.

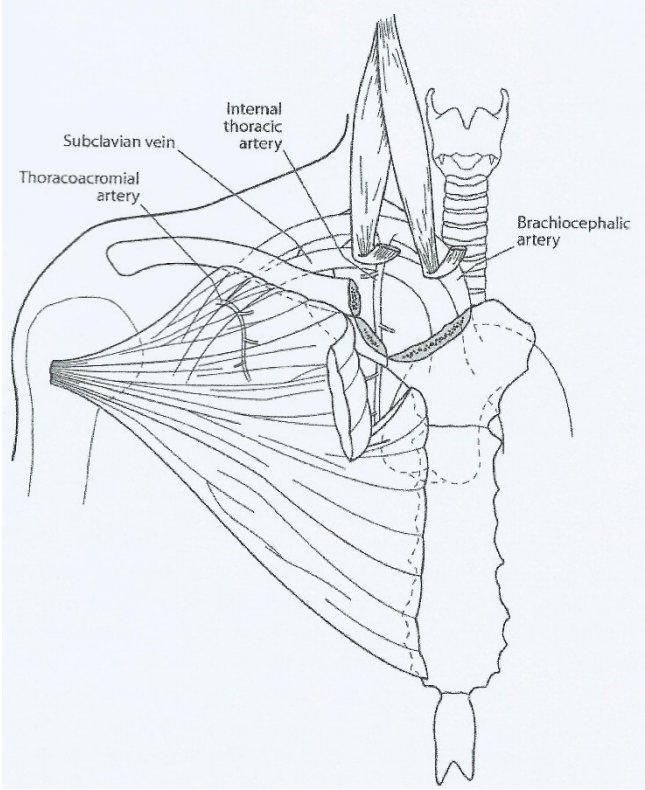

Figure 4 Sternoclavicular joint after exposure and resection

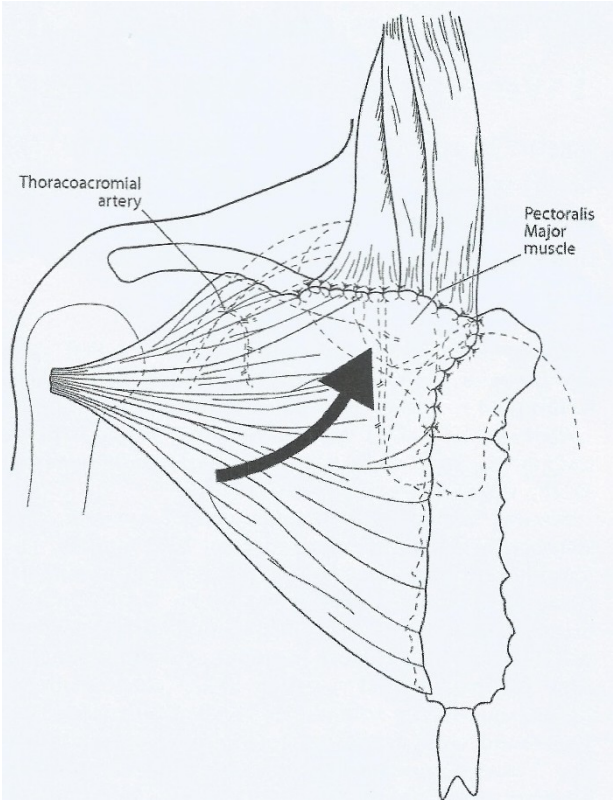

Figure 5 Coverage after resection with pedicled pectoralis major flap

3.5.2 Description of surgical procedure (one typical case)

Under general anaesthesia in suspine position a 10 cm long incision is made directly over the maximum of the swelling at the sternoclavicular joint. During dissection of the soft tissue overlying the joint, purulent secretion is found. A microbiological swab is taken.

Osteomyelitic destruction of the adjoining end of the clavicle can be seen. The affected part of the bone is resected. Necrotic soft tissue is debrided. It is found, that the parasternal part of the first rib is also in part affected by the process. Partial resection, removing all affected bone is done. The internal thoracic artery has to be clipped. Due to the resection of soft tissue and bone structures, the pleural cavity is inevitably opened and a chest tube is inserted.

After the removal of all necrotic tissues and deposits, cautery and hydrogen peroxide swabs secure the haemostasis. The wound is left open and is tightly packed with dressings soaked in saline. Due to sepsis the patient shows cardiorespiratory instability and requires circulatory support as well as artificial ventilation. After the operation the patient is transferred to the ICU.
For the next day a “second look” is scheduled including further debridement and VAC-implantation.

If covering of the resulting defect extending deeply into the soft tissues and sterno-clavicular region is needed, a pedicled pectoralis major muscle flap is applied, once clean granulation tissue has developed. A stabilization of bone is not required. (Fig. 4 and 5)

3.5.3 Non-surgical measures

All patients with sternoclavicular joint infection, treated conservatively and / or surgically, had antibiotic medication. Clindamycin or Piperacillin-Tazobactam was used as first-line standard medication. According to microbiological findings the antibiotic treatment was modified, if necessary. In case of systemic sepsis, or organ dysfunciton the whole spectrum of intensive care treatment was applied.

3.6 Outcome

One patient died 38 days after the first operation due to multiorgan failure following the development of a systemic, multiresistant infection.
After discharge into home care 4 out of 17 patients were re-admitted with a recurrence of the sternoclavicular joint infection that was eventually treated successfully in the follow-up. Five out of 17 patients were transferred to other peripheral hospitals for follow-up treatment and were discharged uneventfully.

4 Discussion

4.1 Microbiological findings

In Ross' "Sternoclavicular Septic Arthritis - Review of 180 Cases" (1) Staphylococcus aureus was responsible for nearly half of the cases, followed by Pseudomonas aeruginosa, which was found in 10% of the abscesses. Also in our collective Staph. aureus was found most frequently (9 out of 17), whereas other types of Staphylococcus was present in four further abscesses. In 4 cases germs other than Saphylococci were found. This is in accordance with the literature on septic arthritis other than sternoclavicular, as Staphylococcus aureus causes approximately 44% of all cases of septic arthritis (17).

Interestingly, the decrease in incidence of Pseudomonas aeruginosa as causative bacterium within the last 20 years (18), was attributed mainly to specific features of intravenous drug abuse. In the 1970s, pentacoines were used and did not need any "cooking" compared to the nowadays most frequently used intravenous drug heroine. Out only patient with a history of intravenous drug abuse was treated conservatively, hence no microbiological swabs were taken.

4.2 Age and gender

As listed in Table 4, the majority of the patients were 51 or older (15 out of 18). None of the patients were younger than 30. With 69 years, the mean age of the collective investigated in the present study is higher than reported in the literature:

The mean age of patients suffering from septic sternoclavicular joint arthritis described by Ross et al (1) was 45 years. However, the collective included a high number of young intravenous drug users. The absence of this specific group of patients in our study, could explain the the marked difference in mean age.

In contrast to other studies, our findings showed that the gender distribution was balanced with 7 male and 11 female patients. In Ross' review of 180 cases (1), 73% of all cases were male. Again, this difference between Ross' and our study might be explained by the high proportion of intravenous drug abusers most of which were male.

4.3 Surgery

17 out of the 18 patients (94 %) were surgically treated with an average intervention rate of 5 procedures including vacuum assisted closures (VAC), the remaining patient had antibiotic therapy only. 10 out of the patients undergoing surgery presented in stages of pronounced destruction of osseous structures requiring resection of bone, debridement of soft tissue necroses and muslce flap coverage. 3 Patients with sternoclavicular osteomyelitis had infectious involvement of the pleural cavity and had chest tube drainage.

Until clean granulation tissue developed a considerable average number of surgical interventions, predominantly including VAC changes (5,6 interventions per patient; range: 1 to 12 interventions) was necessary. This corresponds to long in-patient stay (average: 26,2 days; range: 12 to 86 days).

In Ross' study (1), surgery was performed in 58 % of the patients, including similar procedures like debridement of necrotic tissue, en-bloc resections and VAC changes.

In comparison to other studies dealing with septic arthritis the number of interventions was quite high. This could be due to various reasons: The sternoclavicular joint with its fibrous discus is not too well amenable to antibiotic treatment which shows better penetration into bone, bone marrow and soft tissue. Furthermore, the condition tends to be noticed only when gross destruction of bone or even pleural involvement have already taken place. And finally, there is hardly any viable tissue for direct covering of the resulting defect. Thus repetitive open treatment of the wound with the help of VAC-systems is required.

4.4 Duration of stay

The mean stay at the Critical Care Unit of a SJI patient was 7 days (range: 0-40 days) and the mean total duration of inpatient care was 26 days (range: 10-86 days). The marked need for prolonged intensive care treatment reflects the severity of the disease, albeit affecting only a comparatively small joint.

4.5 Risk factors

Predisposing factors such as intravenous drug use, infection at a distant site, diabetes mellitus, trauma and infected central line have been advocated for sternoclavicular arthritis, whereas no predisposing condition whatsoever was reported in 38% of the patients (1).

The most common risk factor mentioned in the literature is intravenous drug abuse (IVDA) (1). Remarkably, this very feature was present in only one of our eighteen cases. Yet, our patients were an elderly collective in which intravenous drug abuse is uncommon in the first place.

Other authors (1, 4, 7, 10, 11, 22) describe a variety of predisposing factors, including pulmonary or cardiac disease, vasculitis, rheumatoid arthritis, alcohol abuse, HIV infection and use of corticosteroids or anabolic steroids, respectively. In our patients, risk factors such as diabetes mellitus, chronic renal failure, malignant diseases, hepatitis and cirrhosis or pre-existing infections were found. This marked co-morbidity and the mean age which tended to be higher than described in the studies in the literature, contributed to the generally poor general condition our patients were in.

Iinfections at other sites seem to have an influence on developing a sternoclavicular abscess by hematogeneous spread. In the present study infections of the perianal region, multiple abscesses in the lower extremity, osteomyelitis of phalanges, septic gonarthritis and an infectious dental focus were identified. In a review compiling the results of a variety of studies (1), the main infectious focuses seem to have been of occult origin, followed by pneumonia, cellulitis and gingivitis.

4.6 Indicators of prognosis

Intravenous drug abuse was no valid predictor in our collective, because only one patient had a history of IVDA.

Both C-reactive protein (mean : 184,9 mg/l) and Leukocytes (mean: 16,2 G/l) were both markedly elevated at the time of admission, and patients with concomitant hepatic or renal disease showed pathological changes of the respective parameters.

Male patients had higher levels of creatinine and glucose at the time of admission irrespective of presence or absence of diabetes mellitus. Nevertheless, none of the laboratory parameters investigated had any prognostic relevance on the further course or on the length of hospital stay, neither had gender or accompanying diseases.

The obvious correlation we found in our study was the direct connection between duration of in-hospital treatment and the number of necessary surgical interventions. Also, higher age was significantly connected with longer stay at the intensive care unit and prolonged follow-up treatment. These findings are in accordance to studies in septic arthritis of other localization, where higher age had negative influence on the duration of hospital stay. Moreover, we found that the older patients were, the more likely was the need for muscle flaps for wound closure.

5 Limitations

The main problem we faced in our study was the small number of patients with sternoclavicular joint infections, owing to the fact, that it is a very rare disease. Our collective comprised 18 patients seen during the past 20 years.

Because of the retrospective design of the analysis the results predominantly underline existing hypotheses whereas new causal links are hard to identify.

6 Perspective

If any signs of an infectious process at the sternoclavicular joint are present, a CT-scan should be done immediately, in order to detect the condition at an early stage that permits conservative broad-spectrum antibiotic treatment, which – in absence of a microbiological diagnosis – should include staphylococci.

Once osteomyelitis and articular empyema are present, only surgical debridement is effective. Incomplete excision would only result in prolonged course. The older the patients are, the quicker the decision for surgery should be made, because the healing process tends to be prolonged in elderly patients anyway. Also the probability of need for a muscle flap for definitve closure of the defect increases with age.

We were unable to define other prognostic factors based upon laboratory findings or concomitant disease.

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