

# Xiphoidectomy for Intractable Xiphodynia

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## Abstract

**Background** Xiphodynia is a rare condition with hardly any data published regarding xiphoidectomy as a valid treatment option for intractable disease. It is necessary to bear this syndrome in mind after having filtered out other differential diagnoses.

**Methods** Between 2003 and 2015, 11 patients underwent xiphoidectomy for intractable xiphodynia at our institution. Patients' charts were reviewed including preoperative workup, operative technique, and results. Every patient had routine follow-ups, 4 weeks after the procedure and 1 year after surgery.

**Results** The main symptom was chest pain in the area of the xiphoid. Conservative treatment trials with different combinations of analgesics over at least 1 year did not lead to insufficient and long-term improvement, which is why the decision for a surgical xiphoidectomy was eventually made. No postoperative complications occurred. Significant pain relief was achieved in eight out of ten patients; one patient was lost to long-term follow-up. Both patients with insufficient pain relief have had previous surgery in form of a sternotomy and upper median laparotomy.

**Conclusions** Xiphodynia is a diagnostic conundrum, which is why reports on its treatment including surgical resection of the xiphoid are even sparser. So far, this is the largest reported series of surgically treated xiphodynia. Correct diagnosis remains the key factor for success. While tenderness over the tip of the xiphoid process combined with protrusion of the xiphoid with a xiphisternal angle of  $<160^\circ$  are good indications for surgery, patients after previous operations affecting the xiphoid process are less likely to benefit from xiphoidectomy.

## Background

While chest pain is a common and rather unspecific complaint, xiphodynia remains a rare cause of pain in the region of the lower anterior chest wall/epigastric region whose diagnosis is usually only made after exclusion of other pathologies (Table 1) [1–3]. It is necessary to bear this syndrome in mind after having filtered out all potentially life-threatening differential diagnoses, such as

myocardial infarction [4]. Generally accepted as musculoskeletal disorder, its diagnosis relies mainly on clinical examination, as well as imagery. Xiphisternal angles of less than  $160^\circ$  or excessively long xiphoid processes have been linked to xiphodynia [5]. Many possible causes have been suggested; for example inflammation due to mechanical injury, repeated microtrauma to the xiphoid process, displacement of the xiphoid process provoked by weight loss in obese patients or previous operation affecting this region (e.g., sternotomy or median laparotomy) [2, 6–11].

When searching the literature, there are very little data available on xiphodynia and its treatment. References to xiphoidectomy as surgical treatment are strongly

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**Table 1** Differential diagnosis for xiphodynia

Musculoskeletal	Gastrointestinal	Pulmonary	Cardiovascular
Thoracic root pain	Reflux disease	Pulmonary embolism	Angina
Cervical root irritation	Esophagitis	Pleuritic pain	Instable Angina
Rib fracture	Duodenal ulcer	Pneumonia	Myocardial infarction
Sternoclavicular joint arthritis	Gastric ulcer	Pneumothorax	Aortic aneurysm
Costochondritis	Hiatal hernia		Aortic dissection
Tietze syndrome	Cholecystitis	<i>Functional</i>	Pericarditis/effusion
Devils grip	Cholangitis	Anxiety disorders	
Pectoral myofascitis	Cholelithiasis	Hyperventilation Syndrome	<i>Diverse</i>
Sternalis syndrome	Pancreatitis	Depression	Drug induced
Slipping rib syndrome	Strangulated hernia	Somatic symptom disorder	Rheumatic

underrepresented. Yet it is all the more important to know about all options, in case conservative treatment with peroral analgesics and local infiltrations do not lead to the desired improvement. The first curative xiphoidectomy dates back to 1852 according to Lipkin et al. but no mentioning of it is found in either thoracic surgery or orthopedic text books [12].

At our institution, xiphoidectomy has been performed for intractable xiphodynia for over a decade. Below we describe our experience with the surgical treatment of this rare disorder.

## Methods

Between 2003 and 2015, 11 patients underwent xiphoidectomy at our institution. Informed written consent was obtained from all patients prior to study inclusion. Median patient age was 48 years (range 22–70 years). Clinical aspects and comorbidities are listed in Table 2. All patients were male, suggesting male gender as a predisposing risk factor for xiphodynia. The main symptom in all patients was chest pain in the area of the xiphoid process; in two patients, the pain region additionally involved the adjoining rib parts. Six patients complained of pain when lying in a prone position. In three patients, pain was provoked by bending forward or by doing similar movements, e.g., sitting for a long time. In one patient, the pain symptoms were related to stress and another one with chronic obstructive pulmonary disease (COPD) had pain while coughing. During examination, eight patients reported pain during palpation of the xiphoid process. The median duration of suffering from symptoms was 1 year (range 0.5–10 years). Regarding possible etiologies for xiphodynia, seven patients reported that they had suffered from trauma or microtrauma to the anterior chest, happening before appearance of symptoms. Previous

operations as possible cause of xiphodynia were found in three patients (2 sternotomies, 1 upper median laparotomy). Recent weight loss had occurred in another two patients. Conservative treatment with peroral analgesics alone ( $n = 10$ ) or combined with local injections of ropivacaine ( $n = 1$ ) had been tried for at least 6 months before patients were referred to us, in case of an insufficient long-term effect.

Preoperatively, xiphisternal angles were measured on sagittal slides of chest CT scan or X-ray (Fig. 1; Table 3).

## Surgical technique

Xiphoidectomy was performed with the patient under general anesthesia and placed in a supine position. Whereas in the first three cases a 3–5-cm horizontal incision was made over the xiphisternal joint, the later xiphoidectomies were performed through a 3–5-cm longitudinal midline incision. The xiphoid process was visualized and resected in total. The fascia and muscle of the rectus abdominis muscle were then re-approximated with interrupted non-absorbable braided sutures (e.g., Ethibond metric 1; Ethicon Inc., Johnson & Johnson). An “extended xiphoidectomy” with additional polypropylene mesh repair in sublay technique was performed in obese patients or in case of a big gap after resection of a large xiphoid in a total of four patients.

The median duration of xiphoidectomy was 50 min (range 20–80 min).

## Results

No peri- or postoperative complications were noted. Regarding postoperative pain management, four patients received an additional patient-controlled analgesia (PCA) in addition to our standard peroral pain therapy

**Table 2** Patient characteristics

	Age at surgery (years)	Duration of suffering (years)	Main Symptom	Pressure tenderness	Comorbidities	Possible reason for xiphodynia
1	43	1	Pain when lying prone	Xiphoid process and parasternal rib 10 and 11	none	Weight loss
2	70	3	Pain when coughing	Xiphoid process	COPD, HT	Prolonged coughing
3	23	3	Pain when lying prone or when wearing a seatbelt	Xiphoid process	None	Split xiphoid process with spurs
4	33	2	Pain when sitting over a long period	Xiphoid process	Syncopes of unclear origin	Microtraumas while hard working
5	22	3	Pain was stress related	Xiphoid process	None	Slight pectus excavatum treated with corset
6	35	1	Pain during movements	Xiphoid process towards right rib cage	None	Microtraumas/banal sport accident, median upper laparotomy for hernia repair
7	56	0.5	Pain when bending over	Xiphoid process	Open aortic valve replacement via sternotomy	Past sternotomy with subtotal xiphoidectomy
8	61	10	Retrosternal pressure feeling when lying	Xiphoid process and median epigastric region	Bronchial asthma	None (past pericardial cyst resection)
9	49	1	Pain when lying prone	Xiphoid process	Hypercholesterinemia	None (past thoracoscopic sympathectomy)
10	58	1	Pain radiating towards back and shoulders	Xiphoid process and median epigastric region	Myocardial infarction, HT, depression	None
11	48	1	Pain when lying prone, from direct pressure or immediate movements	Xiphoid process	Past morbid obesity with OSAS, Past Helicobacter negative erosive gastritis	Past sternotomy, weight loss, possible microtraumas (karate)

HT hypertension, COPD chronic obstructive pulmonary disease, OSAS obstructive sleep apnea syndrome

(paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs), and opioids if needed).

The median postoperative hospital stay was 2 days (range 0.5–7 days). Two patients were treated on an outpatient basis. All patients were advised not to lift heavy weights of more than five kilograms during the first 6 weeks after surgery. In the knowledge of the low level of evidence, this latter measure was an additional precaution in that patient population, also with regard to their chronic pain situation in the past.

Short- and long-term follow-ups were obtained from ten patients; the 11th patient left the country after short-term follow-up and got further care and follow-up abroad. While all patients reported pain relief 1 month after surgery, only 80% of patients were satisfied with the operation in the long-term follow-up and remained pain free ( $n = 5$ , 50%) or at least described a significant improvement of the pain situation ( $n = 3$ , 30%) which was perceived as good outcome by these patients (Table 3). In the “no residual

pain” group, all patients complained about a distinct xiphoidal tenderness before surgery and 60% ( $n = 3$ ) did show a protrusion of the xiphoid process initially corresponding to a xiphisternal angle  $<160^\circ$ . As predisposing “anatomical factors” one patient had a sternotomy in his medical history. Both patients with insufficient long-term pain relief had previous surgery in form of, respectively, an upper median laparotomy and a sternotomy in their past medical history. Retrospectively, this correlation is plausible and should help to implement an even more successful patient selection for future treatment.

In Patient #6, after initial improvement for 6 months, the pain reoccurred after a sudden strenuous movement and the patient finally came to see us 18 months after the procedure, due to persisting pain. Since neither the clinical examination nor the chest CT scan did show any underlying pathology, a treatment with paracetamol and NSAID was started, but only repeated local infiltrations of the xiphisternal region with a local anesthetic (ropivacaine



**Fig. 1** Measurement of xiphisternal angle in Patient #1

0.75%) resulted in a real short-term pain relief for 2–3 days. Therefore, the decision for a local infiltration with 95% alcohol was made, which resulted in a continuing relief also in this patient but with a persisting feeling of pressure in the epigastric region.

Patient #7 was free of pain shortly after xiphoidectomy and during the first year after surgery. Thereafter, an episode of heavy lifting resulted in a recurrence of epigastric pain, dependent on the weather conditions and the patient's position. An epigastric hernia was ruled out by clinical examination and CT scan. Since the patient's pain was not only localized in the xiphisternal region, but rather extended to the anterior chest and upper abdomen, also local

infiltrations only brought insufficient pain relief. A significant improvement of the symptoms and a more satisfying condition for the patient was only achieved under a treatment with Pregabalin.

## Discussion

Despite its rather heterogeneous description in the literature, xiphodynia can be defined as pain or restrictive sensation of pressure in the region of the xiphoid process, frequently described as being similar to neuralgic pain. There are no clear data regarding the incidence or prevalence of xiphodynia. The fact that it is a diagnosis of exclusion may influence its onset depending on performed examinations. Even if xiphodynia seems to exist in the absence of any other medical conditions, it has been demonstrated in conjunction with life-threatening disease such as cardiac disease, including myocardial infarction, angina pectoris, and pericarditis. It is therefore recommended to carefully investigate all patients presenting acute chest or abdominal pain, to establish a diagnosis and treatment plan where appropriate. The symptoms of gastroesophageal reflux disease should also be emphasized, as a frequent differential diagnosis. In cases where a clear medical diagnosis cannot be established, a simple manual provocative test by application of digital pressure directly to the xiphoid process combined with measurement of the xiphisternal angle in chest X-ray or CT scan may uncover a symptomatic xiphoid process and eventually lead to the diagnosis of xiphodynia. According to the literature, it can be assumed that xiphodynia is not self-limiting and analgesics alone may not be effective for long-term treatment [2, 6]. Nevertheless, local injection of anesthetics and/or steroid combined with peroral analgesics is the primary

**Table 3** Protrusion of xiphoid process, xiphisternal angle and clinical outcome

Patient	Protrusion of xiphoid process	Angle (°)	Previous surgery	Xiphoidectomy, with mesh	1-month follow-up	Long-term follow-up
1	Yes	138	No	Yes	Good	drop out
2	No	148	No	Yes	Good <sup>a</sup>	Great
3	(Yes)	208	No	No	Good <sup>a</sup>	Good
4	Yes	133	No	No	Good <sup>a</sup>	Great
5	No	166	No	No	Good	Good
6	No	156	Laparotomy	No	Good	Poor
7	No	176	Sternotomy	No	Good	Poor
8	Yes	134	No	No	Good <sup>a</sup>	Great
9	Yes	172	No	No	Good	Good
10	No	166	No	Yes	Good <sup>a</sup>	Great
11	Yes	120	Sternotomy	Yes	Good <sup>a</sup>	Great

<sup>a</sup>Pain free

treatment option [2, 6, 12]. In case of short-term benefit, but repeated occurrence of symptoms, xiphoidectomy can be considered as successful and long-lasting treatment option with an assumed low rate of complications [5, 6, 9]. In our opinion, mesh repair should be performed in at-risk patients (with obesity, abdominal wall weakness, past local interventions), to minimize the onset of postoperative epigastric hernia. As far as we can tell from the two patients in our series who underwent an additional mesh repair, this did not result in any adverse effect concerning long-term outcome.

As for the one patient that received alcohol neurolysis because of ongoing neuropathic pain, it has to be stated that we use this technique only as a last resort in case of intractable pain, which responds well, but only very temporarily to local infiltrations with a local anesthetic. Ethanol causes a destruction of nervous tissue by protein denaturation and demyelization and can be used for definitive neurolysis in selected cases of neuropathic pain [13–15].

The main limitation of our study is the small sample size as well as its retrospective nature. Nevertheless, xiphodynia is a rare disease and reports on xiphoidectomy are even sparser, making this the largest existing series that has ever been published on the surgical treatment of xiphodynia so far.

Correct diagnosis remains the key factor of success. Localized tenderness on gentle palpation of the xiphoid process as described by Lipkin et al. seems to be a crucial element of the diagnostic process [12]. Our data are also in line with the work of Maigne et al. who connected abnormal prominence of the xiphoid process with the induction of xiphodynia [5]. For the two patients in our study for whom xiphoidectomy was not successful, we can retrospectively assume some predictors from their medical history, their clinical symptoms, or the results of their preoperative examinations. Only one of the two patients described xiphoidal tenderness, protrusion of the process was not seen in either patient, and the median xiphisternal angle was flatter compared to the groups with much better outcome ( $161^\circ$ ). Additionally, both patients had had a previous operation affecting the region of the xiphoid process. It is conceivable that a previous sternotomy or an upper median laparotomy can provoke a more heterogeneous and multifactorial pain syndrome and thereby worsen the postoperative outcome after xiphoidectomy.

In summary, it can be assumed that localized tenderness on palpation, a sharp angle of a protruding xiphoid and lack of previous surgery in this region are all positive predictors for a beneficial outcome after xiphoidectomy.

Surgical resection of the xiphoid process for xiphodynia is a valid treatment option after common differential

diagnoses are ruled out and after exhaustion of conservative measures such as painkillers (preferably NSAIDs) and/or infiltration with local anesthetics. In our series of 11 patients undergoing xiphoidectomy, a very high success rate with negligible morbidity was achieved. The only two patients who did not benefit from surgery had previous interventions such as laparotomy and sternotomy, respectively, which most probably resulted in a more complex pain syndrome. Furthermore, patients with a xiphisternal angle flatter than  $160^\circ$  tend to benefit a bit less from surgery than those with a steeper angle.

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