Reviews

Treatment and Management of Xiphoidalgia

Nazir Noor[1] [a], Ariunzaya Amgalan[2], Neeraj Vij[3], Kelly Habib[3], Lekha Anantuni[4], Daniel An[2], Hisham Kassem[1], Antonella Paladini[5], Giustino Varrassi[6], Alan D. Kaye[7]

[1] Anesthesiology, Critical Care, and Pain Medicine, Mount Sinai Medical Center, [2] Georgetown University School of Medicine, [3] University of Arizona College of Medicine - Phoenix, [4] Creighton University School of Medicine, [5] MESVA, University of L'Aquila, [6] Via Tacito, Paolo Procacci Foundation, [7] Anesthesiology, Louisiana State University Health Shreveport

Keywords: musculoskeletal pain, xiphoid process, anterior chest pain, xiphoidalgia, xiphoidynia

https://doi.org/10.52965/001c.37070

Orthopedic Reviews

Vol. 14, Issue 3, 2022

Xiphodynia is a rare but debilitating condition that can be described as a form of pain on the xiphisternal joint or any related structures that are anchored to the xiphoid process. Although xiphodynia is a musculoskeletal pain in nature, the pain located in the anterior chest can commonly mislead physicians into pursuing other diagnoses such as cardiac diseases. This leads to a prolonged duration of pain before receiving treatment. In the attempt to alleviate pain resulting from this condition, physicians have previously utilized a range of treatment options, including conservative management, injections, or in severe cases, xiphoidectomy. In this review, we aim to give a brief overview of xiphodynia, including clinical diagnoses and current treatment modalities.

Key Summary Points

1. Xiphodynia can be described as pain radiating from an irritated xiphoid process that can travel to the chest, abdomen, throat, and arms
2. Risk factors for developing secondary xiphoidalgia include GERD, gall-bladder disease, angina pectoris, and coronary-artery disease
3. The treatment of xiphodynia can range from conservative management to injections or a xiphoidectomy
4. Further research is required to develop a standardized treatment protocol and currently the choice of treatment depends on the patient's individual case and the degree of severity

INTRODUCTION

Xiphodynia is a general term used to describe any form of pain that is of the xiphisternal joint or any related structures that are anchored to the xiphoid process. It is a form of pain in the anterior chest that is not commonly diagnosed. The pain is generally more severe with stooping forward, bending the torso, and overeating. Xyphoidynia can also be associated with nausea. Oftentimes, this source of pain can be present for a great deal of time before any diagnosis of xiphodynia is made. This can mean that a significant period of time can pass before patients that are afflicted with xiphodynia receive treatment.[1] Because of the location of the xiphoid process, oftentimes, xyphodynia can send practitioners pursuing alternate diagnoses such as GERD, helicobacter pylori-related ulcers, or other potential causes that are abdominal in nature. Xiphodynia can also be misrepresented for potential causes that are cardiac in nature due to the proximity of the right atrium to the xiphoid process.[2,3] Thus, xyphoidynia, which in reality is a pain that is musculoskeletal in nature, can send practitioners on a confusing goosehunt involving abdominal and cardiac causes that are far from the true nature of the condition.

It is thought that the xiphisternal joint can undergo damage and potentially subluxate during rapid acceleration

a **Corresponding author:**
Nazir Noor
Mount Sinai Medical Center
Department of Anesthesia, Critical Care, and Pain Medicine
4300 Alton Road
Miami Beach, FL, 33130
Phone: (925)-628-6259
naz9noor@gmail.com

or deceleration in traumatic injuries that involve the chest or upper abdomen. Alternate pathophysiologies of the disease can be arthritis or malignant in nature. Osteoarthritis, rheumatoid arthritis, ankylosing spondylitis, Reiter's triad, and psoriatic arthritis can all be associated with xyphoidynia. Regarding malignancies, they can be primary to the site of the xiphoid or resemble metastatic disease from other sites within the body.[2] Interestingly, xiphodynia has also presented as a mid-back pain in a woman following childbirth and as abdominal pain associated with throat pain and a headache.[1]

EPIDEMIOLOGY

Very little is known about the epidemiological characteristics of xiphoidalgia. In a study of 14 patients, Lipkin et al. 1955 found that the majority of patients were between forty and sixty years of age, suggesting that xiphoidalgia requires some duration of time for underlying inflammatory process to occur before the clinical syndrome becomes severe enough to manifest itself as pain at the xiphoid process.[3] No conclusions as to the predisposition of this disease to men or women can be made from this data. Further, this data is from a limited population and may not reflect the epidemiology as a whole.

Dorn et al. 2018 report slightly different epidemiology associated with xiphoidalgia. The 11 patients included in their study were all male, which may suggest a predisposition of males to developing xiphoidalgia. However, there is no determination of whether this is due to an anatomical cause or to a reduced pain threshold in men. They did report an average age of 48 years, which further reinforces the idea that xiphoidalgia may require some duration of time for the underlying disease process to develop into the clinical syndrome.[4]

Secondary xiphoidalgia has a slightly more specific population as it is related to another disease that is not musculoskeletal in nature, which leads to the syndrome of the xiphoid process itself. Populations that are more prone to secondary xiphoidalgia include elderly men due to Gastroesophageal Reflux Disease (GERD) and hypercholesterolemia patients who are thus more predisposed to coronary artery disease. Obese women with multiple children over the age of forty are those most likely to develop gall-bladder disease, and thus this population is also at increased risk of secondary xiphoidalgia.[3,5,6]

Further, xiphoidalgia associated with trauma is associated with another population. A newly published case in the literature displays a case of xiphoidalgia caused by a reactive ossification process in response to the trauma associated with chest compressions. The patient, in this case, a 56-year-old woman, had undergone chest compressions as a life-saving measure after experiencing cardiac arrest. She then proceeded to have a 6-year history of severe epigastric pain. As is often the case, potential causes that are gastrointestinal in nature first come to mind, especially in this demographic, and were the first set of potential diagnoses for the practitioners. However, after ascertaining that this case was not gastrointestinal in nature, xiphoidalgia (elongated in nature in this case) was found to be the cause of the patient's clinical syndrome. This may suggest that elderly patients with underlying cardiac disease who are more prone to receiving chest compressions may also be predisposed to developing traumatic xiphoidalgia.[7]

RISK FACTORS

Occupational risk factors have also been documented in the literature.[1,3,8,9] One case of xiphoidalgia seemed to have an elusive origin until the occupation of the affected individual was uncovered. This individual worked a fruit-picker and repeatedly hoisted heavy crates, which required both an arched back and an awkward strain on the abdomen at the level of the xiphoid. As the disease progressed, the xiphoidalgia was also associated with abdominal pain and throat tightness as well.[3] Many other sources in the literature report the clinical syndrome in those with an occupation involving heavy lifting.[9] In fact, traditionally, xiphoidalgia was thought to be a disease of men who returned to work involving heavy lifting after temporarily being inactive.[3]

The birthing of children is another potential risk factor. Maigne et al. 2010 report a case where the severity of disease followed closely with the third trimester of a twin pregnancy, implying that pregnancy may be a risk factor.[6] Further, the presentation of a case of moderate xiphoidalgia after the delivery of one child and then relatively severe xiphoidalgia (with pain as high as 7-8 out of 10) after the delivery a second child may point towards of vaginal delivery as a significant risk factor for the development of xiphodynia.[1]

The most important risk factors for secondary xiphoidalgia are the primary diseases that are associated with it. These include GERD, gall-bladder disease, angina pectoris, and coronary-artery disease.[3] Patients with these diseases are significantly more likely to develop secondary xiphoidalgia than others. Thus, excessive alcohol intake and consumption of red meat is a risk factor of secondary xiphoidalgia, with respect to GERD. Obesity and having given birth to many children are also risk factors for secondary xiphoidalgia as they are associated with gall-bladder disease. Lastly, heart disease or a history of cardiac events are also risk factors for secondary xiphoidalgia.[5,6]

Another important risk factor for xiphoidalgia is trauma to the lower chest or upper abdomen. There are several cases that report the clinical syndrome after a severe fall or accident on the abdomen.[6] In all of these cases, the xiphosternal angle was notably reduced from the mean of 172° to as low as 105° in one case. This suggests that any risk factor that can reduce the xiphosternal angle is also a risk factor for xiphoidalgia. It also presents a potential diagnostic screening tool in those who are more likely to develop xiphoidalgia.[6]

CLINICAL PRESENTATION

Xiphodynia can be described clinically as pain radiating from an irritated xiphoid process that can travel to the

chest, abdomen, throat, arms, and head.[1] The xiphoid process is located at the base of the sternum and can have a variation in its shape or size and present as broad, pointed, or curved.[1] The pain of xiphodynia is elicited when the sensitive portion of the xiphoid process is palpated forcefully by a clinician.[3] The most common symptoms associated with xiphodynia are "cardiac chest pain, epigastric pain, nausea, vomiting and diarrhea, and pain that radiates to the back, neck, shoulders, arms, and chest wall".[1,9,10]

The clinical presentation of xiphodynia is variable due to the referred pain that it causes, as well as the ability to be mistaken for other disorders related to cardiac, abdominal, or thoracic diseases.[11] Typical differential diagnoses made are pulmonary embolisms, peptic ulcer disease, cholelithiasis, and coronary artery disease.[9] Case reports have been published demonstrating the similarity of the symptoms of coronary artery disease and xiphodynia. For example, a case report by Tanaka et al. described a 79-year-old man with a past medical history of stroke, diabetes, and a partial gastrectomy who presented with epigastric pain on exertion. An electrocardiogram (EKG) conducted revealed normal sinus rhythm and no ST changes. A diagnosis of unstable angina was made, and a percutaneous coronary intervention was performed successfully, yet the patient still complained of epigastric pain. A CT scan revealed not only elongation of the xiphoid process (>5 cm), but also pain produced on palpation of the xiphoid process and the diagnosis of xiphodynia was made. This case highlights an example of the symptoms of xiphodynia mimicking acute coronary syndrome.[5] Koren *et al.* further demonstrated the overlap of symptoms between acute coronary syndrome and xiphodynia. Their case report described a 52-year-old woman with sharp retrosternal pain with a normal EEG, no relief of pain with sublingual isosorbide dinitrate, and sharp pain elicited from palpation of the xiphoid process, confirming the diagnosis of xiphodynia.[12] Therefore, the previous case reports demonstrated the importance of the physical exam in terms of palpating the xiphoid process as well as imaging showing the abnormality of the shape of the xiphoid process.[5]

More recently, the etiology of xiphodynia has been of interest since it could help illuminate the associated clinical symptoms. A theory by Hogerzeil et al. examines the possibility of patients having a period of being overweight that causes anterior displacement of the xiphoid process followed by a period of weight loss where the xiphoid process still remains displaced, causing pain.[11] The case report outlined a 61-year-old male mechanic with multiple microtraumas from lifting tires and weight gain, causing anterior displacement of the xiphoid process on a radiograph. Three years later, the patient complained of nausea, abdominal pain, and a feeling that the bones in his sternum were "sliding over each other," and the follow-up x-ray showed the same anterior displacement of the xiphoid process.[11] Another case report by the same authors outlined a 55-year-old male with pain over his xiphoid process and had the same progression of being overweight (BMI 30.6 kg/m^2) and losing 17 kg resulting in a BMI of 25.6 kg/m^2 and a CT scan revealing a protruding xiphoid process.[11]

DIAGNOSIS

Due to the relative novelty of the disease as well as the possibility to mistake it for other more common diagnoses, there is not a set criterion for making a diagnosis of xiphodynia. The diagnosis of xiphodynia is primarily dependent on the physical exam, where applying pressure to the xiphoid process reproduces pain symptoms in the patient.[1] Furthermore, due to the fact that many patients present with a chief complaint of chest pain, clinicians should perform a careful history and physical exam to rule out dangerous and life-threatening diagnoses such as angina pectoris, myocardial infarction, and pericarditis before settling on the diagnosis of xiphodynia.[1] A case report by Koren et al. demonstrates the clinical similarities of symptoms of xiphodynia with myocardial infarctions. The researchers describe the case of a 52-year-old woman with a past medical history of hypertension and a presenting symptom of sharp retrosternal pain. A physical exam maneuver of palpating the xiphoid process elicited the patient's chest pain, and an initial EKG was normal, so a diagnosis of xiphodynia was made. However, 24 hours later, the patient's pain came back, and a repeat EKG was consistent with the diagnosis of myocardial infarction. This case demonstrates the dangers of diagnosing xiphodynia without excluding more life-threatening conditions as well as the possibility of a painful xiphoid process on physical exam not being the best indication that the diagnosis is always xiphodynia.[12]

Instead of relying on the physical exam maneuver of a painful xiphoid process upon palpation, Maigne et al. described the diagnostic technique of using the angle of the xiphoid process measured in a CT scan as another way to diagnose xiphodynia.[6] The researchers outlined three case reports of patients with xiphodynia: a 30-year-old woman whose xiphodynia was caused by pregnancy, a 64-year-old man who suffered from a severe fall on the abdomen that displaced the xiphoid process, and a 76-year-old man who had a sternotomy for valve surgery and reported xiphodynia afterward. These three patients were compared with a control group of 30 males with a mean age of 55 +/- 1 year and 30 females with a mean age of 54.4 +/- 2 years without xiphodynia who had CT scans for other reasons. The three case reports of patients with xiphodynia revealed that the xiphosternal angle in a CT scan was 105°, 135°, and 120° which was compared to a mean of 172 +/- 15° in the control group of 60 people without xiphodynia. The researchers proposed that the anterior displacement of the xiphoid process is responsible for the discomfort and inflammation that patients with xiphodynia experience. They also suggested that the degree of the prominence could be measured using a CT scan in patients with a possible diagnosis of xiphodynia. Due to the relative rarity of the disease as well as the small sample size of patients with xiphodynia in the study, further studies need to be done to confirm the accuracy of measuring the displacement of the xiphoid process as a diagnostic technique.[6]

CONSERVATIVE MANAGEMENT

The treatment of xiphodynia can range from conservative management to injections or a xiphoidectomy. The choice of treatment depends on the patient's individual case and the degree of severity. This section will outline conservative treatment approaches for patients with xiphodynia in the literature. In cases where xiphodynia seems to be a one-time case for a patient, clinicians should provide reassurance to patients as well as suggest treatments such as analgesics like non-steroid anti-inflammatory drugs (NSAIDs) or a topical heat or cold pack or anti-inflammatory gel.[1,11] Furthermore, in cases where xiphodynia is secondary to another disease process such as an acute coronary syndrome or GERD, those diseases must be treated successfully before a treatment approach for xiphodynia is attempted. Lipkin et al. have also urged that the clinician provide reassurance for the patient due to the fact that the pain of xiphodynia may lead the patient to believe they have underlying heart disease and can cause anxiety.[3] Unfortunately, there have not been any studies evaluating the effectiveness of physical therapies or conservative treatments like NSAIDs or compresses in the treatment of xiphodynia, so their effectiveness should be called into question.[1]

Most cases of xiphodynia are not a one-time case, and many patients have to deal with the chronic pain associated with it. Dorn et al. outlined 11 cases of xiphodynia where different trials of analgesics over at least one year did not provide any long-term improvement, so a xiphodectomy was eventually recommended.[4] Due to the anatomic disturbance that can occur with xiphodynia with anterior displacement of the xiphoid bone and the chronic nature of the disease, conservative treatments may not always be effective.[11] Ultimately, more studies need to be performed on the effectiveness and different conservative managements for xiphodynia, and until then, clinical judgment, as well as the patient's unique case, will determine the management of the disease.

MINIMALLY INVASIVE MANAGEMENT: INJECTIONS AND LASER THERAPY

Xiphodynia used to be widely accepted as a self-limiting pathology; however, that is no longer the prevailing theory.[1] Evidence on the efficacy and mechanisms of xiphoidalgia treatment is limited, largely anecdotal, and varies across the literature. Even so, the standard of injection therapy involves an anesthetic, steroid, or both in the xiphoid area. The resolution of symptoms after xiphoid injection is used both diagnostically and therapeutically.[13] For instance, the diagnosis was made in one patient case report when an intramuscular injection of 75 mg of diclofenac sodium resolved pain for 24 hours.[12] In a landmark study in 1955, Lipkin et al. not only described xiphoidalgia for the first time but also evaluated some treatment options. For instance, one to three injections of procaine in the area was shown to provide pain relief, although the mechanism for this result is poorly understood.[3] A similar study from 1979 found that two injections of 2% xylocaine led to long-term symptom resolution in 5 of 6 tested patients.[13] Later, a case series in 1992 achieved short-term pain relief in two patients using an injection of 3mL 1% xylocaine with 2mL 40mg/mL triamcinolone solution.[9] A third patient in that 1992 study had relief of pain one week after injection of 7mL of half 1% lidocaine and half 0.5% bupivacaine.[9] In evaluating those three patient cases, the case series found that 25 gauge needles – as opposed to 22 gauge needles – allowed for reduced patient discomfort during the procedure.[9] Additionally, injection of 5 to 7 mL of anesthetic was superior to 10 mL due to the reduced deformity of the area.[9] Outcomes of the injection procedure were equivocal if there was minimal xiphoid tenderness or if other tender points existed on the anterior chest wall.[9] Finally, a study in 2014 identified 14 patients with xiphodynia out of 457 with chest pain. Eight of these patients were administered injections of 40mg depot methylprednisolone and 50mg lidocaine to the most tender point of the xiphoid process. Of the six patients that followed up, 5 had complete resolution of pain. The patient who did not subsequently received a second injection and recovered thereafter.[14] Complications of any of these injections can include pleural, peritoneal or organ perforation, pneumothorax as well as infections.[1,9] A chest radiograph is, therefore, indicated after injecting the area to assess the presence of some of these complications.[9]

Low-level laser therapy (LLLT) is additionally gaining acceptance as a treatment for various musculoskeletal pain disorders. Its use for xiphodynia specifically has been minimally studied; however, a few published case reports have alluded to its utility. In one such patient case, following the diagnosis of xiphodynia, a trial of two treatments per week over the course of four weeks was used. Each treatment involved 2 minutes of LLLT to $4cm^2$ around the xiphoid. At the end of the treatment course, the xiphoid no longer was tender to palpation, and associated symptoms of throat tightness had resolved.[1] A large systematic review of LLT use in fibromyalgia showed significant improvement in pain severity, the number of tender points, fatigue, stiffness, depression, and anxiety compared to a placebo.[15] It could, therefore, be an avenue for further comprehensive studies in the management of xiphoidalgia.

SURGICAL MANAGEMENT: XIPHOIDECTOMY

Surgical management of xiphodynia involves a complete xiphoid resection – xiphoidectomy - and may be done for cases that are unresponsive or refractory to conservative and injection-based management.[3] Studies evaluating a surgical intervention for this condition are exceedingly sparse. However, xiphoidectomies are more often performed during gastrointestinal surgeries for improved visualization of the abdomen. From this research, we know that time required for the procedure is 7-15 minutes, and complications due to bleeding from the internal mammary artery are easily controlled with cautery. Additionally, none of the thirty cases had an incisional hernia 12 months postoperatively.[16]

Lipkin et al. affirm that the first curative xiphoidectomy was performed in 1852; however, more information about this procedure has not been recorded.[4] In a retrospective study done with 40 patients, the pain was evaluated on the Wong-Baker 10-point visual pain scale prior to surgery as well as four weeks post-operatively. In all patients, reduction in xiphoid pain after surgery was significant, changing from 9 or 10 down to 0 to 2, and hospital stay was one day.[17] Of the 40 subjects, nine returned to full activity in sports 4 to 6 weeks after the surgery.[17] In a case study evaluating two patients, xiphoidectomy eliminated pain and associated symptoms of abdominal pain and nausea at eighteen-month and thirty-month follow-up visits, respectively.[11] At another institution, 11 patients with xiphoidalgia underwent surgical resection of the xiphoid with no operative complications. They recommended using a mesh repair in patients with obesity, abdominal wall weakness, or prior local interventions to reduce the risk of a subsequent incisional hernia. The surgical benefit was more significant for those with a xiphisternal angle of >160°. Median hospital stay duration was two days for these patients. While 100% of this cohort reported no pain 1 month post-operatively, 80% remained pain-free at a longer term follow up. Researchers correlated this recurrence of pain to operations – such as laparotomy and sternotomy – performed prior to the xiphoidectomy. Additionally, one patient in the cohort required local alcohol infiltration post-operatively to reduce neuropathic pain, but responded well to the intervention.[4] Similarly, a case of a 53-year-old surfer with xiphoid pain that was refractory to analgesics had complete resolution of pain 26 days after a xiphoidectomy.[18] In cases of anatomic deformities, such as heterotopic ossification of the xiphoid in one case, surgical excision is a viable treatment. The pain had resolved two weeks after the operation.[7] Due to a short hospital stay and minimal to no postoperative complications, one group suggested that the procedure be performed on an outpatient basis.[19]

One postoperative complication is the ossification of the xiphoid remnants after xiphoidectomy, which is triggered by the destruction of the cartilage. Of 15 xiphoidectomies performed for better upper abdominal visualization in various gastrointestinal surgeries, three patients ultimately experienced bone formation from their abdominal scars up to nine months after the operation. This is also known as myositis ossificans traumatica. It is believed that if part of the cartilage or perichondrium remains attached to the sternum after resection, heterotopic bone formation can occur and cause discomfort or pain in patients.[20] Further research in the use of xiphoidectomy in xiphoidalgia, along with its long-term complications, is required to better evaluate its use in management.

CONCLUSION

Xiphodynia can be described as pain radiating from an irritated xiphoid process that can travel to the chest, abdomen, throat, arms, and head. Although xiphodynia is a musculoskeletal pain in nature, the pain located in the anterior chest can commonly mislead physicians into pursuing other diagnoses such as cardiac diseases. This will cause a significant period of time to elapse before patients receive the treatment for xiphodynia. Furthermore, secondary xiphoidalgia is commonly seen in patient populations with primary diseases such as GERD, gall-bladder disease, angina pectoris, and coronary artery disease, all of which could show symptoms similar to xiphodynia. Due to the insufficient understanding of the disease, there is not a set criterion for making a diagnosis of xiphodynia, and more research is needed to confirm the accuracy of diagnostic techniques. In addition, while current treatment options for xiphodynia can range from conservative management to injections or a xiphoidectomy, the lack of large studies comparing and evaluating the effectiveness of these treatments makes the current management for xiphodynia to be mainly based on clinical judgments rather than a standardized treatment protocol. With a better understanding of the causative etiology and establishment of better clinical practice for patients with xiphodynia, we can hope to improve the quality of life of these patients.

Submitted: June 18, 2021 EDT, Accepted: March 28, 2022 EDT

REFERENCES

1. Simpson JK, Hawken E. Xiphodynia: A diagnostic conundrum. *Chiropr Osteopat*. 2007;15:1-6. doi:10.1186/1746-1340-15-13

2. Waldman SD. *Atlas of Uncommon Pain Syndromes*.; 2014.

3. Lipkin M, Fulton LA, Wolfson EA. The Syndrome of the Hypersensitive Xiphoid. *N Engl J Med*. 1955;253(14):591-597. doi:10.1056/nejm195510062531403

4. Dorn P, Kuhn MA, Schweizer BA, Schmid RA, Kocher GJ. Xiphoidectomy for Intractable Xiphodynia. *World J Surg*. 2018;42(11):3646-3650. doi:10.1007/s00268-018-4668-9

5. Tanaka Y, Sakata K, Waseda Y, et al. Xiphodynia mimicking acute coronary syndrome. *Intern Med*. 2015;54(12):1563-1566. doi:10.2169/internalmedicine.54.3449

6. Maigne JY, Vareli M, Rousset P, Cornelis P. Xiphodynia and prominence of the xyphoid process. Value of xiphosternal angle measurement: Three case reports. *Jt Bone Spine*. 2010;77(5):474-476. doi:10.1016/j.jbspin.2010.04.009

7. Vu TND, Aho JM, Puig CA, Reisenauer JS. Heterotopic Ossification of the Xiphoid After Chest Compressions. *Ann Thorac Surg*. 2019;108(6):e347-e348. doi:10.1016/j.athoracsur.2019.03.110

8. Ugurlar OY, Ugurlar M, Ozel A, Erturk SM. Xiphoid syndrome: an uncommon occupational disorder. *Occup Med (Chic Ill)*. 2014;64:64-66. doi:10.1093/occmed/kqt132

9. Howell JM. Xiphodynia: A report of three cases. *J Emerg Med*. 1992;10(4):435-438. doi:10.1016/0736-4679(92)90272-u

10. Eulálio Filho WMN, Barbosa DJM, de Sousa Junior EC. Xiphodynia: a rare cause of epigastric pain. *Intern Emerg Med*. 2018;13(1):127-128. doi:10.1007/s11739-017-1720-y

11. Hogerzeil DP, Hartholt KA, de Vries MR. Xiphoidectomy: A Surgical Intervention for an Underdocumented Disorder. *Case Rep Surg*. 2016;2016:1-3. doi:10.1155/2016/9306262

12. Koren W, Shahar A. Xiphodynia masking acute myocardial infarction: A diagnostic Cul-de-Sac. *Am J Emerg Med*. 1998;16(2):177-178. doi:10.1016/s0735-6757(98)90041-9

13. Sklaroff HJ. Xiphoidynia-another cause of atypical chest pain: six case reports. *Mt Sinai J Med*. 1979;46(6):546-548.

14. Shilo L, Hadari R, Shabun A, Shilo D, Kitay-Cohen Y. Xiphodynia: An easily diagnosed but frequently overlooked cause of non-cardiac chest pain. *J Musculoskelet Pain*. 2014;22(4):378-381. doi:10.3109/10582452.2014.962212

15. Yeh SW, Hong CH, Shih MC, Tam KW, Huang YH, Kuan YC. Low-level laser therapy for fibromyalgia: A systematic review and meta-analysis. *Pain Physician*. 2019;22(3):241-254.

16. Mihmanli M, Köksal HM, Demir U, Işil RG. Total gastrektomide ksifoidektominin yarari: Teknik not. *Turkish J Surg*. 2016;32(1):47-49. doi:10.5152/ucd.2015.2817

17. Olivencia-Yurvati AH. Xiphodynia surgical management. *Int Surg*. 2017;102(9-10):412-416. doi:10.9738/intsurg-d-16-00181.1

18. Sano A, Inui M. Xiphoidectomy for xiphoid process-induced pain in a surfer. *Asian Cardiovasc Thorac Ann*. 2015;23(9):1116-1118. doi:10.1177/0218492315589198

19. Swarup A, Phillips JD, Finley DJ. Excision of the xiphoid process for chronic pain: patient characteristics and results. *Am J Respir Crit Care Med*. 2018;197(MeetingAbstracts):5860.

20. Watkins G. Bone formation in abdominal scars after Xiphoidectomy. *JAMA - J Am Med Assoc*. 1964;89:731-734.