**A CASE REPORT: ACUTE APPENDICITIS IN A SEAMAN**

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**ABSTRACT**

Appendicitis is one of the most common causes of acute abdominal pain, with a lifetime risk of 8.6% in males and 6.7% in females. Mortality from acute appendicitis in developed countries is low, at 0.3%, but rises significantly to 1.7% after perforation. The cause of appendicitis likely stems from obstruction of the appendiceal opening or lumen. This results in inflammation, localized ischemia, perforation, and the development of a contained abscess or perforation with resultant peritonitis. Clinical symptoms and signs suggestive of appendicitis include a history of central abdominal pain migrating to the right lower quadrant (RLQ), anorexia, fever, and nausea/vomiting. The patient usually has a low-grade fever (<38°C). The variable location of the appendix causes variations in the clinical presentation, making diagnosis challenging. The clinical diagnosis of acute appendicitis is based on patient`s history, physical examination, laboratory values (such as a high white blood cell count), and imaging. The differential diagnosis of appendicitis remains a clinical challenge because appendicitis can mimic several abdominal conditions. Those conditions include a variety of gastrointestinal, vascular, genitourinary and gynaecological diseases. Immediate appendectomy, via open laparotomy or laparoscopy, is considered the gold-standard treatment for acute appendicitis. Intravenous antibiotics may be considered first-line therapy in selected patients. Delays in diagnosis and treatment significantly contribute to increased incidences of perforated appendicitis, which typically occurs within 24 to 36 hours of the onset of symptoms.

The case of a male seafarer, 34 years old, who developed colic-type abdominal pain on the twelfth day of a voyage on a merchant ship is presented. Patient was transferred to the island of Terseira by a Portuguese military helicopter, and then by ambulance for another hour and a half to Santo Espirito Hospital, island of Terseira. After a physical examination and diagnostics, a diagnosis of acute abdomen was made and a laparoscopic operation to remove the appendix was performed. The patient was discharged 4 days after surgery for home treatment, and he arrived home on the fifth day after the operation. The surgeon's report on the follow-up examination was satisfactory, and the patient is allowed to return to normal work activities 3 weeks after the operation.

Literature reviews were conducted in order to find data on the incidence of acute appendicitis in seafarers at sea on merchant ships, the procedures for providing medical assistance at sea, and the mortality rate. Searching the available articles and the internet, no data was found about cases of acute appendicitis among seafarers on poison ships, nor statistical data on the incidence of occurrence among seafarers. Seafaring poses a high risk-occupation within an isolated environment. In case of sudden illness or an accident and injury during the ship’s voyage, the chances of receiving proper and effective treatment is not as good for seafarers as for workers on shore. The availability of a Radio medical center or TMAS has greatly facilitated the provision of first aid on ships that do not carry a doctor, but in cases of more serious injuries or acute medical conditions, professional medical assistance is required in equipped hospital conditions.

***Key words: seamen, seafarers, acute appendicitis, medical assistance onboard, maritime***

## INTRODUCTION

Appendicitis is inflammation of the appendix, a small, tubular organ in the right lower abdomen that is attached to the large intestine (1). Acute appendicitis occurs at a rate of about 90–100 patients per 100 000 inhabitants per year in developed countries. The peak incidence usually occurs in the second or third decade of life (2). Appendicitis is one of the most common causes of acute abdominal pain, with a lifetime risk of 8.6% in males and 6.7% in females (3). Mortality from acute appendicitis in developed countries is low, at 0.3%, but rises significantly to 1.7% after perforation, demonstrating the importance of early diagnosis and treatment (4).

### *Causes*

The cause of appendicitis likely stems from obstruction of the appendiceal opening or lumen. This results in inflammation, localized ischemia, perforation, and the development of a contained abscess or perforation with resultant peritonitis (5). This obstruction may be caused by lymphoid hyperplasia, infections (parasitic), fecaliths (stone-like structure made of hardened feces), or benign or malignant tumours (1,5). When an obstruction is the cause of appendicitis, it leads to an increase in pressure, resulting in small vessel occlusion and lymphatic stasis. Once obstructed, the appendix fills with mucus and becomes distended, leading to ischemia and necrosis. Appendicitis is most often a disease of acute presentation, usually within 24 hours, but it can also present as a more chronic condition (5). The patient will usually present with sudden onset of abdominal pain with associated nausea or vomiting (6).

### *Symptoms*

Clinical symptoms and signs suggestive of appendicitis include a history of central abdominal pain migrating to the right lower quadrant (RLQ), anorexia, fever, and nausea/vomiting (7). More than half of patients first experience discomfort in the midabdominal area, which later becomes more localized to the right lower abdominal area (1). Migration of pain from the epigastric region or periumbilical area to the right lower quadrant, also known as the Volkovich-Kocher sign, is an important symptom at the beginning of the disease (8). Pain on walking or coughing can also be suggestive of appendicitis (4). On examination, RLQ tenderness, along with “classical” signs of peritoneal irritation (e.g., rebound tenderness, guarding, rigidity, referred pain), may be present (7).

Appendicitis is often associated with a low-grade pyrexia, but presence of a high fever may suggest perforation and widespread peritonitis. Family history of bowel disorders such as cancer or inflammatory bowel disease is important (4).

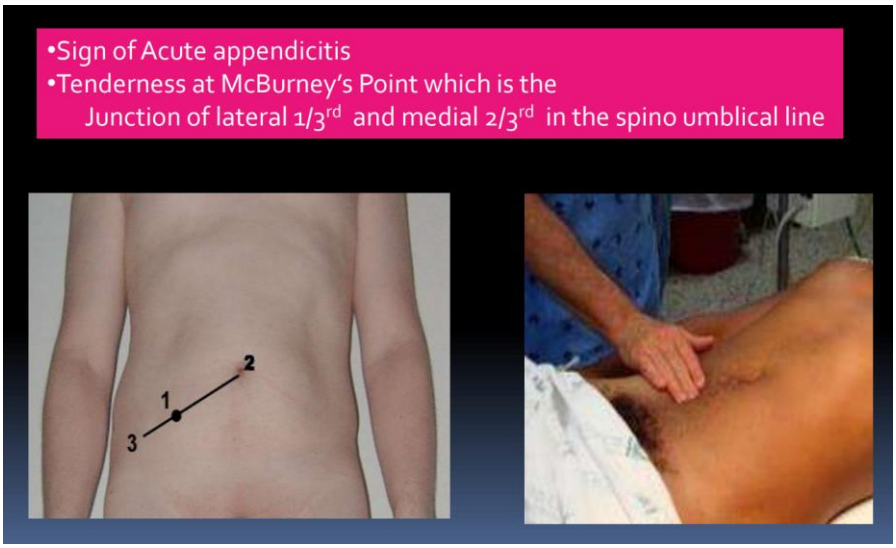
Patients usually lie down, flex their hips, and draw their knees up to reduce movements and to avoid worsening their pain. The duration of symptoms is less than 48 hours in approximately 80% of adults but tends to be longer in elderly persons and in those with perforation. Approximately 2% of patients report duration of pain in excess of 2 weeks. A history of similar pain is reported in as many as 23% of cases, but this history of similar pain, in and of itself, should not be used to rule out the possibility of appendicitis (9).

The patient usually has a low-grade fever (<38°C) with associated tachycardia and appears flushed and with a dry tongue and fetor oris. The patient often lies still as movement and coughing exacerbate the pain (8).

### *Appendicitis signs*

The appendix usually lies underneath McBurney’s point (defined above) and therefore palpation at this location (Figure 1) will often be painful in acute appendicitis (4).

Figure 1.

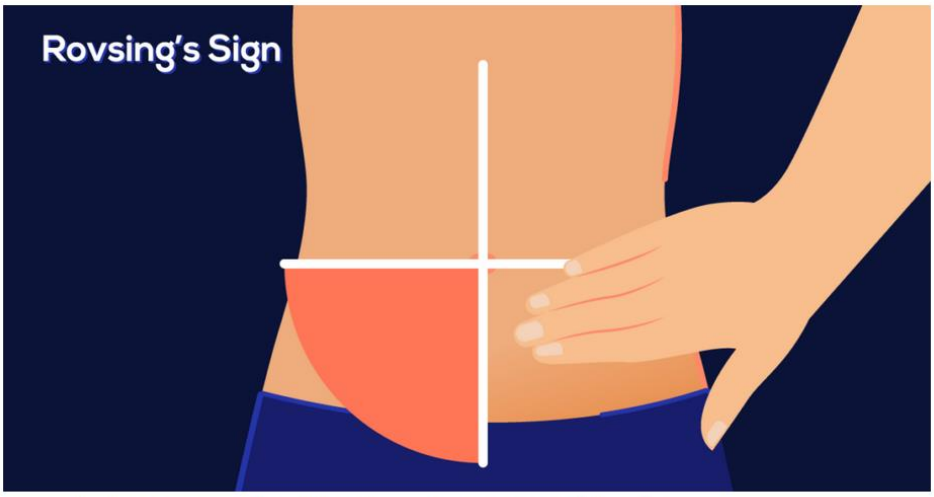



*McBurney`s Point. Taken from: https://www.slideshare.net/easwaramoorthy/top-10-signs-in-gastroenterology*

The variable location of the appendix causes variations in the clinical presentation, making diagnosis challenging (10). Here are several specific tests for appendicitis, which may be carried out during the examination:

• Rovsing's sign – palpation in the left iliac fossa causing pain in the RIF, due to stretching of irritated peritoneum (Figure 2)

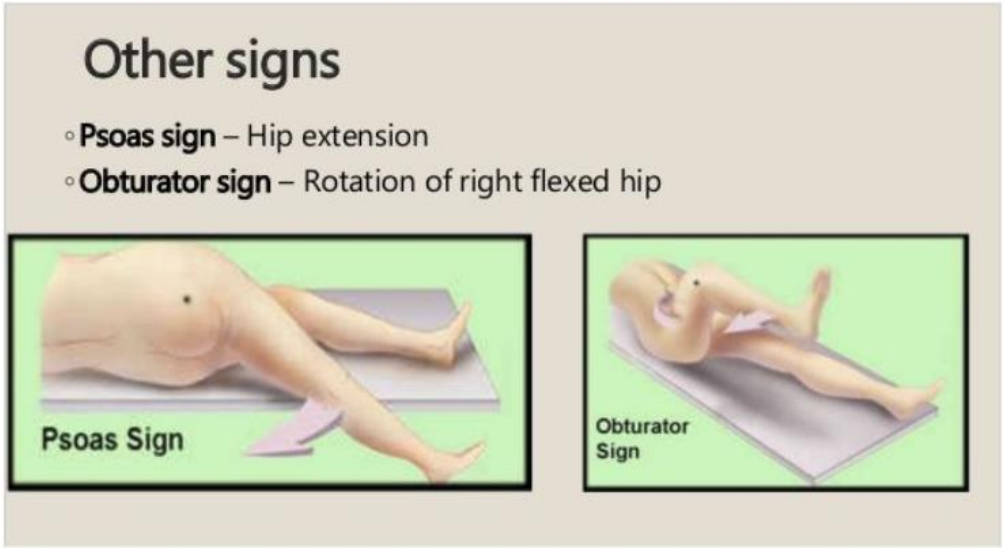
Figure 2.




*Rovsing`s sign is tenderness of the right lower quadrant, when the left quadrant is palpated. Taken from:* https://tinymedicine.org/what-is-acute-appendicitis/

• Cope's obturator sign – flexion and internal rotation of the hip causes pain due to local irritation of the obturator muscle by an inflamed pelvic appendix (Figure 3)

Figure 3.




*Psoas sign – pain on hyperextension of right hip, while patient is lying left lateral with knee extended. Obturator Sign is an indicator of irritation to the obturator internus muscle. Taken from:* https://www.pinterest.com/pin/860398703780989767/

• Iliopsoas sign – similar to the above, flexion of the thigh against resistance causes pain due to inflammation of the psoas muscle (Figure 3).

These signs have varying sensitivity and specificity but can be worthwhile adjuncts to an abdominal examination.

Findings on examination of a rigid abdomen i.e. generalised guarding indicate generalised peritonitis and immediate resuscitation and sepsis management should be instituted (4).

***Diagnosis***

The clinical diagnosis of acute appendicitis is based on patient`s history, physical examination, laboratory values (such as a high white blood cell count), and imaging (Figure 4)(1,11).

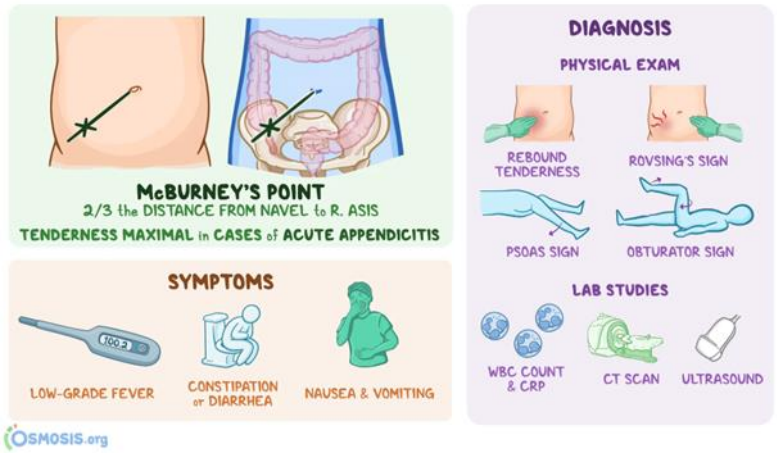
Each and every clinical sign for appendicitis alone has a poor predictive value. Bhangu et al., in their study presented several clinical risk scores that have been developed, the purpose of which is to identify low, intermediate, and high-risk patients for appendicitis, allowing further investigations to be stratified according to risk (2).

The basic laboratory tests that are needed in the early diagnosis of acute appendicitis are just a few. These tests are available in the majority of the health facilities and do not take too much time to obtain the results. They are complete blood count (CBC) that includes a white blood count (WBC) with a differential count. The WBC is a good inflammatory marker that measures the quantitative changes of an inflammatory process and usually run parallel with the increasing temperature. C-reactive protein (CRP) can be used in the late stages of acute appendicitis to confirm complicated appendicitis such as gangrene or perforation of the appendix (8). Mild elevation of serum bilirubin can be a marker for appendiceal perforation with a sensitivity of 70% and a specificity of 86%. Blood amylase can be useful in ruling out pancreatitis (4).

The urinalysis determines if there is excessive number of red cells that could be related to an episode of ureteral calculus. It also may show acetonuria which may be related to anorexia and fasting

state. In women of childbearing age, a pregnancy test used is in order to rule out pregnancy (8). Presence of leucocytes on urinalysis may indicate inflammation of a pelvic appendix or may suggest an alternative diagnosis such as a urinary tract infection (particularly in the presence of nitrites) (4).

**Figure 4.**




*Taken from: https://www.osmosis.org/answers/mcburneys-point*

Ultrasonography (US), computed tomography (CT), and magnetic resonance imaging (MRI) are options for the evaluation of patients with suspected acute appendicitis (10). The choice of imaging modality for each clinical condition is variable and as such being familiar with those differential diagnoses is vital in deciding what is the best imaging modality for every patient presenting with abdominal pain.

The most common imaging modality used in patients with right-sided abdominal pain is abdominal and pelvic CT, which has a sensitivity of 97% and a specificity of 98%. Classical features suggestive of appendicitis on CT include concentric and thickened appendiceal wall, the presence of an appendicolith, fat stranding, mesenteric lymphadenopathy and the presence of surrounding fluid. The presence of other features such as appendiceal wall defect, extraluminal air or localised abscess is more suggestive of a perforated appendix.

Ultrasound (US) has a sensitivity of 78% and a specificity of 83%. Features suggestive of appendicitis on ultrasound include dilated (>6 mm outer diameter) non-compressible appendiceal wall, hyperechoic appendicolith with posterior acoustic shadowing, peri appendiceal fluid collection and mural hyperaemia on colour flow Doppler mode (12). Some authors suggest that sensitivity goes to 92-3% (2).

The use of magnetic resonance imaging (MRI) depends on accessibility as it differs from one hospital to another. The presence of other more readily accessible imaging modalities such as computed tomography and ultrasound makes the use of magnetic resonance less popular. Features suggestive of appendicitis on MRI include the presence of dilated appendix (>7 mm outer diameter), fat stranding and restricted diffusion (12).

***Differential diagnosis***

The differential diagnosis of appendicitis remains a clinical challenge because appendicitis can mimic several abdominal conditions (9, 13) Those conditions include a variety of gastrointestinal, vascular, genitourinary and gynaecological diseases (12). In general, when the diagnosis of acute appendicitis is not clear, the clinician has to take into consideration other diagnostic possibilities, and

the best form to do it is to assess the patient according to the anatomical location of the pain or tenderness. If the pain is localized in the right lower quadrant, the most probable causes are appendicitis, stump appendicitis, inflammatory bowel disease, diverticulitis (cecal, Merkel's), mesenteric adenitis, intestinal obstruction, hernia, ectopic pregnancy, salpingitis, ovarian cyst, mittelschmerz, nephrolithiasis, pyelonephritis, and ureteral calculus (8). The use of imaging modalities such as abdominal and pelvic ultrasound (US), computed tomography (CT) and magnetic resonance imaging (MRI) can be crucial in assessing those equivocal cases with vague nonspecific symptoms (12).

***Treatment***

Immediate appendectomy, via open laparotomy or laparoscopy, is considered the gold-standard treatment for acute appendicitis (10, 14).

Intravenous antibiotics may be considered first-line therapy in selected patients (10). Antibiotic therapy is usually administered intravenously first, then orally. The antibiotics used amoxicillin + clavulanic acid, cefotaxime, or a fluoroquinolone. Metronidazole or tinidazole can be added. The total duration of antibiotic treatment is 8 to 15 days (15). Increasing evidence suggests that broad-spectrum antibiotics, such as piperacillin-tazobactam monotherapy or combination therapy with either cephalosporins or fluroquinolones with metronidazole, successfully treats uncomplicated acute appendicitis in approximately 70% of patients (11).

Pain control with opioids, nonsteroidal anti-inflammatory drugs, and acetaminophen should be a priority and does not result in delayed or unnecessary intervention (3).

The International Ship's Medical Guide and the Ship's Captain's Medical Guide give the following instructions for suspected appendicitis:

- The first step is to obtain radio-medical advice and get the patient to hospital as soon as possible.
- Keep the patient in bed until disembarking from the ship. Take his temperature, puls and respiration rate hourly. No food and liquid intake if the patient can reach hospital within 4 to 6 hours.
- Insert an intravenous cannula and give normal saline (0.9% sodium chloride), one litre every six hours.
- Give ceftriaxone, 2 g intravenously or intramuscularly, daily, or benzyl penicillin 600 mg intramuscular and metronidazole 400 mg at once, then repeat both every 8 hours for 5 days. In case of allergy to penicillin, give erythromycin 500mg and metronidazole 400mg at once, then repeat every 8 hours, for 5 days.
- Treat severe pain (16, 17).

***Complications***

Delays in diagnosis and treatment significantly contribute to increased incidences of perforated appendicitis (14), which typically occurs within 24 to 36 hours of the onset of symptoms. Perforation of the appendix can cause intra-abdominal infection, sepsis, intraperitoneal abscesses, and rarely death (7). Sepsis can occur in 17% to 32% of patients with acute appendicitis. Patient-related risk factors for perforation include older age, three or more comorbid conditions, and male sex.

***Recovery***

If the patient had surgery, they need to continue to monitor the incision site for any signs of infection such as redness, swelling, drainage, or increased pain and report these to their surgeon. Normal activity can usually resume within a few days to a week. However, the patient should avoid any

strenuous activity and heavy lifting for the first 4-6 weeks. Frequent small walks should be encouraged (5).

There is no consensus regarding the optimum duration of antibiotics. Guidelines propose 3 to 7 days of treatment, but shorter courses may be as effective in the prevention of infectious complications. At the same time, the global issue of increasing antimicrobial resistance urges for optimization of antibiotic strategies (17).

**CASE REPORT**

Male patient, 34 years old, position on board as 2nd Engineer, total working experience on board five years. Previous medical was done the day before boarding the ship, all findings were normal, blood count within reference limits. He had no complaints or symptoms. The first complaints appeared 12 days into the trip, on August 29, when suddenly during the night, around 3 o'clock in the morning, he started to feel colic-type stomach pains. The pain was not strong at first. He had no other symptoms. In the morning of the same day, pain started to intensified and he informs the Captain about his health condition. Following the instructions of the ship's medical guide he receives the antibiotic Amoxicillin 1g every 8 hours, the first dose was taken on the same day at 11 pm, 20 hours from the onset of pain. The second officer was in charge of first aid and giving medicine.

The next day at 7 a.m. he takes a second dose of antibiotics. The Captain, in the meantime, informed the maritime agency from Croatia, which referred him to their doctor, from whom he would receive the further instructions. The doctor gave instructions for performing the examination, based on painful palpation points when pressing and relaxing, he suspected that it was appendicitis. Given that more than 24 hours have passed since the onset of symptoms, and that this is a dangerous medical condition that requires immediate surgical intervention, and that further diagnostics, an ultrasound or CT scan of the abdomen, as well as a blood analysis and CRP, are required to determine the stage of the inflammation, doctor advised immediate disembarkation from the ship and transport to the nearest health facility that provides surgical services.

Patient was transferred to the island of Terseira by a Portuguese military helicopter around 11 a.m., and then by ambulance for another hour and a half to Santo Espirito Hospital, island of Terseira. He was admitted to the hospital with abdominal pain in the right iliac fossa, colic type, without radiating pain, with 48 hours of evolution, and with worsening movements of the right lower extremity. Denies fever, nausea and vomiting. He had loose stools the previous day. Physical examination revealed that the abdomen is objectively flat, soft, painful on palpation of the right iliac fossa and with signs of peritoneum irritation. Laboratory analyses at admission are as follows: Hgb 14.2 g/dl without leucocytosis, neutrophils 78.2%, urea 21mg/dl, creatinine 1.01 mg/dl., ionogram without significant changes, normal liver profile 1cr of 2.39mg/dl and procalcitonin 0.04 ng / ml. Type II urine, no leukocytes, negative nitrates. Abdominal CT (without contrast) showed thickening of the cecal appendix (16 mm) was confirmed, with densification of the surrounding fat due to inflammatory phenomena, without images of abscesses. Free peritoneal effusion in small volume pelvic excavation. No other anomalies to value.

Considering the clinical picture, a laparoscopic appendectomy was postponed, which the patient accepted. A laparoscopic appendectomy was performed on 30.09. at 5 p.m. Symptomatic therapy, surgical site infection prophylaxis and venous thromboembolism prophylaxis were carried out.

The post-operative course went smoothly. At the time of discharge, the patient was hemodynamically stable, apyretic, tolerated lifting and diet, and pain-free. Further care includes

dressing the wound every other day and 8 days after surgery removing the sutures. Amoxicillin and clavulinic acid 500+125 1 tablet every 12 hours and Brufen 600 mg 1 tablet every 8 hours were prescribed for therapy. The patient was discharged on October 2nd, 4 days after surgery for home treatment, and he arrived home on the fifth day after the operation. A control examination by the surgeon in the home country was performed 11 days after the operation when the sutures were removed. The surgeon's report on the follow-up examination is satisfactory, and the patient is allowed to return to normal work activities 3 weeks after the operation.

***Availability of data***

Literature reviews were conducted in order to find data on the incidence of acute appendicitis in seafarers at sea on merchant ships, the procedures for providing medical assistance at sea, and the mortality rate. Databases included PubMed, ResearchGate, JAMA, NCBI, ScienceDirect, etc. Keywords used were "seafarer", “seaman”, "appendicitis", "merchant ship". Searching the available articles and the internet, no data was found about cases of acute appendicitis among seafarers on poison ships, nor statistical data on the incidence of occurrence among seafarers.

**DISCUSION**

Seafaring poses a high risk-occupation within an isolated environment. According to telemedical reports, the most frequently observed medical emergencies were related to surgical (46%), internal (27%) and urological (6%) health disorders (19).

In case of sudden illness or an accident and injury during the ship’s voyage, the chances of receiving proper and effective treatment is not as good for seafarers as for workers on shore (20). Most of the time, merchant ships do not carry a doctor or other health professional on board, and the healthcare is in the hands of the captain or his delegate when seafarers are injured or ill (21). Seafarers’ lack of medical staff on board, their low level of medical knowledge, and the limited availability of medical supplies place them in a disadvantageous position compared to those living ashore (22). Seafaring is therefore a dangerous occupation with a higher morbidity and mortality rate than in most occupations onshore (20).

Ships, especially those on long voyages or in remote areas, can be far from medical facilities or specialized care. This makes it difficult to access timely medical assistance in case of need. Having limited medical resources and specialized equipment can hinder the delivery of comprehensive medical care onboard (23).

In the event of diseases or accidents, individuals on board ships will try to arrange treatment for themselves or, in more severe cases, will seek the advice of a Telemedical Maritime Assistance Service (TMAS) or the intervention of rescue media to bring sick or traumatized (MEDEVAC) persons ashore. It is difficult for ship captains or officers charged with on board medical assistance to describe the symptoms or injuries of seafarers simply due to their limited medical knowledge. As a result of this challenge, the TMAS doctor will ask several questions to arrive at a presumptive diagnosis, which will determine the appropriate treatment of the problem (22). Limited or unreliable satellite connections can hinder real-time consultations with onshore medical professionals and delay diagnosis and treatment. In case of medical emergencies, timely evacuation to a shore-based medical facility may be necessary. However, arranging medical evacuations at sea can be logistically complex and expensive, especially in adverse weather conditions (23).

## CONCLUSION

Seafaring is characterized by harsh working conditions, a hostile environment, isolation and limited access to professional medical care. In case of illness or injury, seafarers, especially on cargo merchant ships, receive first aid from their colleagues, Captains or officers, who, although trained in first aid, have limited medical knowledge and limited medical supplies at their disposal. Ships are often several days away from a port where they can receive the necessary assistance, or poor weather conditions make evacuation by helicopters or medical ships impossible.

The availability of a Radio medical center or TMAS has greatly facilitated the provision of first aid on ships that do not carry a doctor, but in cases of more serious injuries or acute medical conditions, professional medical assistance is required in equipped hospital conditions. A big obstacle in seeking medical advice is also the language barrier between the patient, the first aid provider and the doctor on the other side of the line. The composure of the patient himself to adequately describe his symptoms and not to diminish their importance is also very important, in order to receive adequate and timely medical care. On the other hand, adequate first aid training for Captains and officers is of great importance, because the timely provision of first aid depends on the level of their training and acquired knowledge.

Finally, I will convey to you the words of the sailor whose case was presented "The most important thing is that a person does not take his health lightly, but with great fear before departure and while on board".

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