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EMERGENCY RADIOLOGY

REVIEW ARTICLE



# Emergency radiology in displaced populations: imaging and practical challenges

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**ABSTRACT**

Migrants and refugees tend to use emergency departments as their primary source of care, leading to a substantial increase in emergency radiological imaging. Migrants and refugees have risk factors, such as low vaccination rates, poor hygiene, malnutrition, and inadequate self-care, which increase their risk of contracting infectious diseases. For example, the prevalence of tuberculosis among refugee populations in host countries is increasing, and imaging findings related to tuberculosis are frequently observed by radiologists. Strengthening screening programs in host countries for tuberculosis and other infectious diseases among migrant populations can help mitigate the risk of transmission within migrant communities. Another condition, cystic echinococcosis, is more common among refugees and migrants from the Middle East and Afghanistan. For radiologists working in host countries, echinococcosis involving the liver and lungs should be considered in the differential diagnosis. Both intentional (e.g., violence, assault) and unintentional (e.g., workplace injuries, accidents) traumas are frequently encountered in emergency radiology, particularly among refugees and immigrants. Workplace injuries are four times more common among migrants and refugees than among the local population due to their work in high-risk industries, such as construction and heavy industry, and emergency radiology frequently encounters radiological findings of organ injuries due to falls from height. In addition, healthcare professionals in emergency radiology face various challenges when dealing with migrant and refugee patients, such as communication barriers, social security problems, and psychological distress.

**KEYWORDS**

Refugee, migrant, emergency radiology, tuberculosis, echinococcosis, firearm injury, computed tomography

Due to wars and economic hardships in the Middle East, Asia, and Africa, the number of migrants and refugees in developed countries, such as European Union (EU) countries and the United States (US), is high. Most frequently, it is the emergency departments of hospitals that migrants and refugees use to receive healthcare services. There is a rise in emergency imaging due to an increased workload in emergency departments, the higher incidence of infections not common in host countries, and the greater number of occupational injuries and forensic cases.[1] This increased workload, combined with incomplete patient histories, may result in delayed reporting by emergency radiologists, as well as inaccurate or incomplete interpretations. The aim of this study is to review the radiological findings of diseases whose incidence is expected to rise in host countries due to increased migration.

## Notable data on migration

Word choice is important in migration-related contexts. Migration is the movement of people from one place to another, often across an international border, regardless of the reason. An immigrant is a person who comes to live permanently in another country to improve their material and social situation. Due to war in places such as Syria, Palestine, Afghanistan, Sudan, and Ukraine, the US and European countries have become target destinations for refugees, particularly in the last two decades. According to a United Nations High Commissioner for Refugees (UNHCR) report, 122.6 million people had been displaced worldwide as of 2024. The US has the highest number of asylum applications, followed by Germany, Türkiye, Germany, Iran, Colombia, and Uganda, which host approximately 32% of the world's people in need of international protection.[2]

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Türkiye provides international and temporary protection for refugees and has implemented a temporary protection system for Syrian refugees. According to data provided by the Turkish Directorate of Migration Management, the number of Syrians under temporary protection in Türkiye was 3,088,863 as of October 2024.[3] Although the gender distribution of this group is equal, three-quarters are under the age of 35. In the Mediterranean and Eastern Mediterranean regions, most asylum seekers and refugees are male, and 70% are under the age of 35.[4] According to the Turkish Directorate of Migration Management, the most frequently apprehended irregular migrants in Türkiye were from Afghanistan and Syria, peaking in 2019 and 2022.[3] According to European Commission data, the irregular migrants who were illegally in the EU in 2022 included Syrians (175,960), Afghans (119,520), and Moroccans (60,215). The EU countries where these people are mostly found are Hungary, Germany, and Italy, respectively.[5]

## Increase in emergency service admissions and radiological imaging for migrants and refugees

The most important situation faced by countries of migration is the provision of healthcare to refugees and migrants.[6] Although migrants, such as those in the Eastern Mediterranean, typically have better initial health status than that of the host population, this advantage tends to diminish over time due to various socioeconomic factors.[7] A study conducted in Canada showed that the health of immigrants deteriorated 10 years after their arrival compared with before.[8] It has been reported that common reasons why refugees and migrants do not attend healthcare appointments are language problems, transportation problems, and health insurance problems.[9] In many countries, there exist barriers related to health insurance coverage and healthcare costs in the provision of health services. In Türkiye, however, the costs of health services for refugees under temporary protection are covered by the Disaster and Emergency Management Presidency of the Ministry of the Interior.

Migrants and refugees tend to use emergency departments as their primary source of healthcare.[10] Compared with local people, their rate of emergency department admission is significantly higher, particularly for pediatric patients.[11-14] It has been reported that among migrants and refugees, emergency admissions are more common for men than for women and that musculoskeletal injuries and traumatic conditions are frequently found in young men.[15] Accordingly, there is an increase in emergency radiological imaging of migrants and refugees in emergency departments.[16] Access to emergency departments in Türkiye is free of charge for Syrians under temporary protection, and one-third of emergency department admissions have been reported to be inappropriate.[17] Emergency departments in Türkiye are frequently preferred by Syrian immigrants because doctors' examinations, laboratory tests, and radiological imaging are free of charge.[18,19]

**Main points**

- According to the United Nations High Commissioner for Refugees, the country with the highest number of asylum applications is the United States, followed by Germany.
- Migrants and refugees tend to use emergency departments as their primary source of healthcare, and this has led to an increase in the use of radiologic imaging in emergency departments.
- The prevalence of tuberculosis is increasing among migrants and refugees in host countries, and host country radiologists should be familiar with tuberculosis radiology.
- Migrant workers are at higher risk of fatal accidents than local workers, and multiple organ injuries are frequently identified through imaging in emergency radiology.
- Radiology personnel in host countries may face challenges such as language barriers, cultural sensitivities, incomplete medical histories, and limited access to social security or imaging services among migrants.

## Diseases with increased frequency detected upon emergency radiology in host countries

In emergency departments, where immigrants frequently seek healthcare, the utilization of radiological imaging is increasing (Figure 1).

## Infections

Local people in host countries believe that refugees/migrants are at high risk of bringing infectious diseases.[20] Low vaccination rates, lack of hygiene, malnutrition, and low levels of self-care among migrants and refugees increase the incidence of infectious diseases.[21] Beyond malnutrition, the intake of contaminated or low-hygiene food during migration can elevate the risk of gastrointestinal infections. Additionally, dietary restrictions stemming from cultural or religious beliefs may contribute to inadequate nutrition and digestive issues in the host country. As a result, migrants and refugees are at increased risk of highly contagious bacterial and viral respiratory system infections, urinary infections, and gastrointestinal tract infections.[22] In a study conducted in Türkiye, urinary tract infections were reported as the most common diagnosis in emergency department admissions of pediatric and adult female migrants.[23] During the coronavirus disease-2019 pandemic, the crowded living spaces of large groups of migrants/refugees, poor hygienic conditions, a lack of preventive measures, and difficulties in accessing vaccines increased the risk of contracting the disease.[24]

## Tuberculosis

Tuberculosis is the world's leading cause of death from a single infectious agent, with an incidence of 2.9 per 100,000 people.[25,26] In 2015, 558 new cases were diagnosed among Syrian refugees.[22,27] In 2010, approximately 25% of newly diagnosed patients with tuberculosis in the EU were migrants.[28] Due to the increase in Syrian and Ethiopian refugees coming to Lebanon, an increase in the frequency of tuberculosis has been observed in that country.[29] The World Health Organization (WHO), UNHCR, and the European Center for Disease Prevention and Control have recommended that countries of origin provide active tuberculosis screening.[30] Tuberculosis is transmitted by droplets among refugees and migrants with poor hygienic conditions and results in symptoms such as coughing, weight loss, and fever, with its frequency increasing among refugees/migrants in countries that accept migration.[31,32]

In tuberculosis, the lungs are particularly affected, as seen with extrapulmonary tuberculosis with hematogenous spread. A person who is exposed to *Mycobacterium tuberculosis* for the first time (usually respiratory) develops signs of primary pulmonary tuberculosis. Although these people are often children in endemic areas, the disease can also be seen in adults in the countries of migration. Lymphadenopathy is a common finding, and computed tomography (CT) imaging typically shows peripheral contrast enhancement with central radiolucency in affected lymph nodes. Lobar or segmental consolidation may also be present in cases of primary pulmonary tuberculosis.[33,34]

Post-primary tuberculosis, however, is typically seen in adults with reactivation of the bacillus. It is usually characterized by upper lobe involvement, cavitations, fibrosis, and tracheobronchial spread. Active

tuberculosis should be considered in the differential diagnosis when lymphadenopathy, consolidation, centrilobular nodules, or peribronchial thickening are detected upon CT imaging of migrants with clinical findings, such as fever, night sweats, coughing, and chest pain. Miliary tuberculosis is defined by hematogenous spread of the infection and is characterized on CT by widespread centrilobular nodules, predominantly in the lung bases (Figure 2).[34]

### Echinococcus granulosus

Cystic echinococcosis is a parasitic (Echinococcus granulosus) disease that is transmitted from dogs to humans through intermediate hosts.[35] In Argentina, the Middle East, and China, the incidence of cystic echinococcosis is reportedly 5/10,000 people.[36] In Europe, it is more common in refugees/migrants of Middle Eastern and Afghan origin. Although liver and lung involvement are frequent, it can involve any part of the body.[37-39] The liver is reportedly the most commonly affected organ, whereas the lungs are more frequently involved in children (Figure 3).[40-42]

The diagnosis of hepatic hydatid cysts is primarily based on ultrasonography, with the ultrasound classification system for hepatic cysts developed by the WHO used in such cases (Figure 4). In this classification, CE1 and CE2 group cysts are defined as active, CE3 group cysts as transitional, and CE4 and CE5 groups as inactive and important for treatment and follow-up.[43] Complications of cystic echinococcosis include cyst rupture or superinfection of the cyst, which may result in anaphylaxis.

### Hepatitis

In a study conducted among 7,629 immigrants in GeoSentinel clinics, the prevalence of viral hepatitis was found to be 17%.[44] However, it has been reported that the frequency of hepatitis in immigrants is similar to the frequency in the countries of origin. Hepatitis B virus and hepatitis C virus infections have been reported to be more common in men than in women in countries with high immigration rates.[45,46] Ultrasonography may reveal findings consistent with acute hepatitis, such as hepatomegaly, increased gallbladder wall thickness, decreased parenchymal echogenicity, and increased periportal echogenicity.[47]

### Human immunodeficiency virus and opportunistic infections

It has been reported that there are no patients who are human immunodeficiency virus (HIV) infected among the refugees coming to the US from the Middle East, whereas HIV is detected in 3.3% of African refugees.[48] This virus has been found in 0.7% of Iraqi refugees entering the US and in 4% of immigrants/refugees in the United Kingdom.[21,49] As a result, although the HIV rate among immigrants/refugees is lower than in local populations, infections due to factors such as Toxoplasma gondii, Pneumocystis jirovecii, Cryptococcus neoformans, *M. tuberculosis*, Cytomegalovirus, and herpes simplex virus can be identified upon emergency radiological imaging (Figure 5).[50]

## Trauma

### Intentional trauma

In emergency radiology for migrants and refugees, trauma-related injuries are among the most common conditions requiring imaging after infections. Migrants and refugees often work in the construction and industrial sectors, and safety measures are often insufficient in host countries. Accordingly, injuries due to work accidents are frequently seen in migrants and refugees. It has been reported that refugees have workplace injuries four times more frequently than local people (Figure 6).[51,52] In a study conducted in Saudi Arabia, 89% of the employees in the construction sector, 41% of whom reported workplace accidents, were migrant and refugee workers, and they suffer these traumatic injuries at a higher rate than the local population.[53] In addition, studies conducted in different countries have reported that migrant workers have a higher risk of fatal accidents than local workers.[54-56]

### Unintentional trauma

It is believed that the rate of involvement in judicial incidents and crime among migrants and refugees is higher than among the local population in the host countries.[57] However, although it varies according to the country of migration and settlement, it has been reported that the rate of involvement of local people in judicial incidents is higher than that of migrants and refugees.[58] In a study by Yüzbaşıoğlu and Çıkrıkçı Işık[51], it was reported that traffic accidents were the most

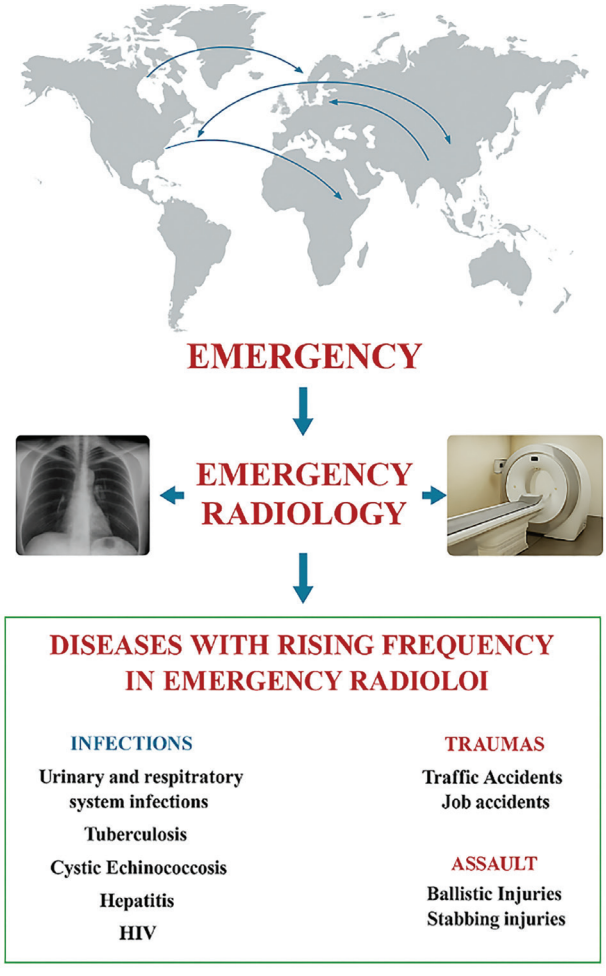


**Figure 1.** Flowchart of migrants and refugees in emergency radiology.

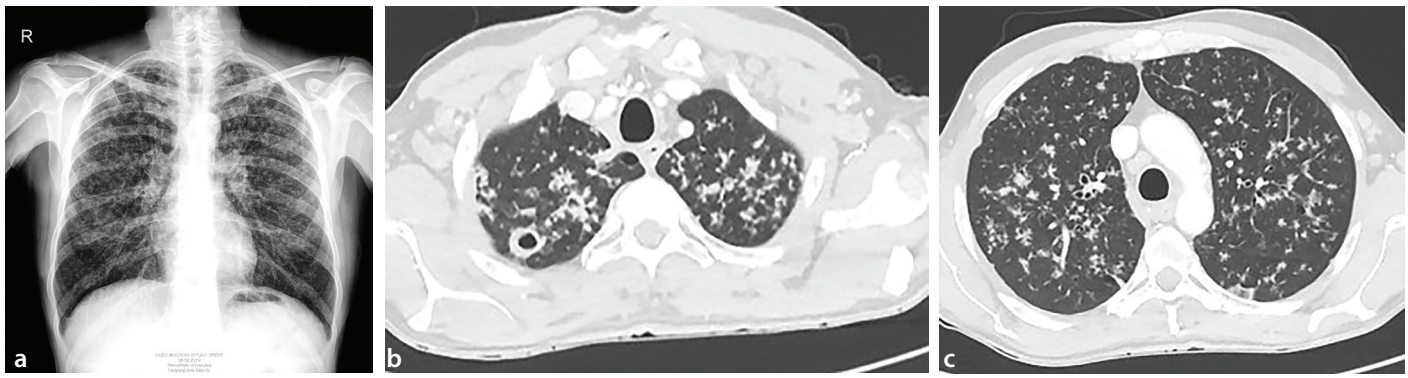


**Figure 2.** A 41-year-old Afghan man presented with cough and fever. **(a)** Chest X-ray revealed diffuse nodular radiopacities in the upper lung zones. **(b, c)** Computed tomography scans showed diffuse millimetric centrilobular nodules in the upper lobes and middle lobe, with cavitary nodules in the right upper lobe. Miliary tuberculosis was suspected, later confirmed by laboratory tests detecting *tuberculosis bacilli.*

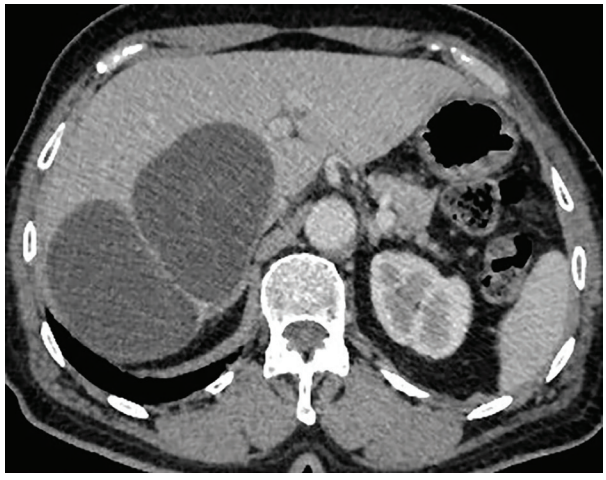

**Figure 3.** A 38-year-old foreign man was diagnosed with a hydatid cyst in the posterior superior segment of the right hepatic lobe based on computed tomography imaging and laboratory confirmation.

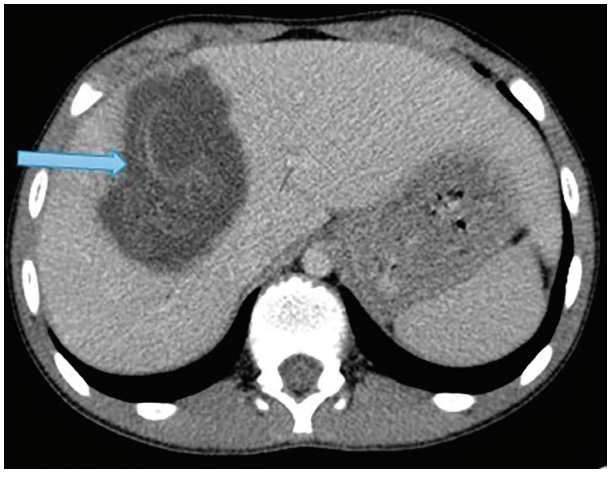

**Figure 4.** In a 22-year-old foreign man, axial computed tomography imaging showed a cystic lesion in the right liver lobe with a detached membrane (arrow), confirming hydatid cyst.

common incidents (27.4%), with assaults the second most common incidents among migrants and refugees who presented at emergency departments for forensic reasons. In a study conducted in Switzerland, 14.6% of cases were related to assaults and 10.2% to traffic accidents, with the extremities being the most commonly affected sites.[59] A study conducted in Lebanon found that local people and refugees were admitted to hospital at similar rates as a result of road traffic accidents.[60] According to a study by Duzkoylu et al.[18], in a settlement area close to the Syrian border, trauma (36.8%) was the most common reason for the hospital admission of refugees/migrants; it was reported that this rate was higher than that for the local population and that the assault rate (2.5%) was significantly lower than that for the local population. Regarding hospital admissions, the most common sites of injury were reported to be the extremities and the head and neck (Figure 7).[18,60]

Firearm injuries are reportedly among the top five causes of death in the US.[61] A Canadian study reported a lower risk of firearm injuries for immigrant children and adolescents than for non-immigrant locals. In addition, the study reported that the risk of assault-related firearm injuries was higher among long-term migrants than among non-immigrants (Figure 8).[62] In Sweden, foreign-born adults reportedly have a higher risk of firearm-related death than locals.[63] In a study conducted in Lebanon, knife and gun injuries were found to be significantly higher among the refugee population than among the local population (Figure 9).[60] Metallic and non-metallic foreign bodies related to prior trauma, particularly in immigrants fleeing war, may be detected on radiological imaging, especially in the extremities. Sequelae of gunshot wounds, including retained bullets or fragments, are also commonly observed in emergency radiology.[64]

## Problems encountered in the evaluation of migrants and refugees in emergency radiology

### Communication and language problems

Although there are interpreters in hospitals, migrants and refugees are often not able to communicate effectively. Incorrect or incomplete communication may result in improper patient positioning, failure to follow simple instructions such as breath holding, and difficulties in understanding the patient's clinical complaint or medical history. These issues can lead to artifacts in

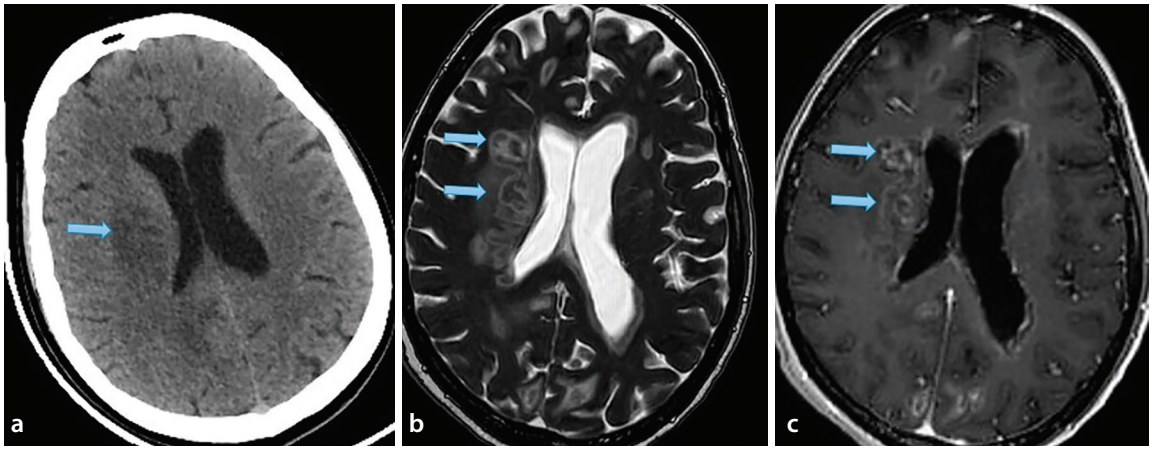


**Figure 5.** A 35-year-old woman who was HIV positive presented with severe headache and confusion. **(a)** Non-contrast brain computed tomography showed low-density lesions (arrows) in the right periventricular white matter. **(b)** Magnetic resonance imaging revealed peripheral hyperintense lesions with vasogenic edema (arrows) in T2-weighted images, with **(c)** peripheral contrast enhancement (arrows) on T1-weighted images, leading to a diagnosis of cerebral toxoplasmosis. HIV, human immunodeficiency virus.

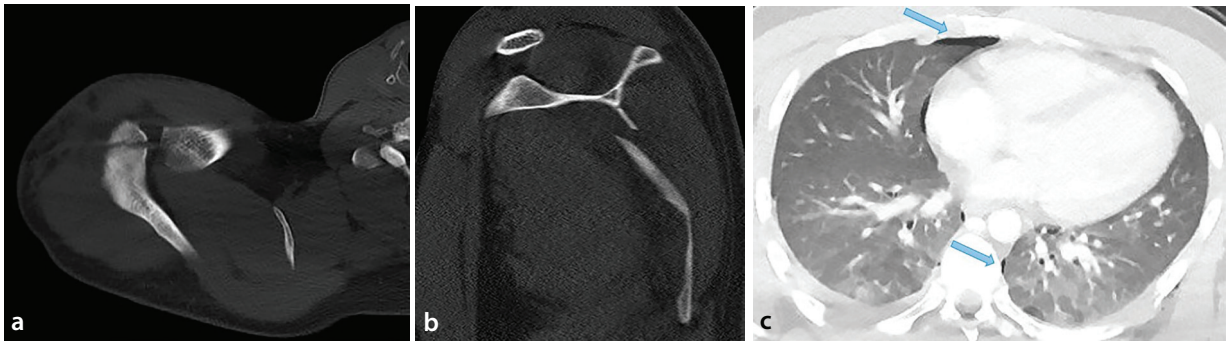


**Figure 6.** A 23-year-old Afghan man fell from construction scaffolding. **(a, b)** Computed tomography scans revealed right scapula and acromion fractures, along with **(c)** bilateral pneumothorax (arrow).

imaging, producing non-diagnostic images and increasing the risk of inaccurate or incomplete reporting. It has been reported that the length of emergency department stay increases for patients who use interpreters compared with those who do not.[65] This can be explained by a better understanding of patient complaints and the use of more appropriate communication methods.

## Social security and insurance problems

It has been reported that the average cost of treatment for Syrian war victims is approximately US $1,336.[66] In their study, Karakuş et al.[1] reported that the average cost per case of wounded war victims brought to the emergency department near the Syrian border was approximately US $1,295. Other studies report that the possibility of not being able to afford hospital-related health expenses often results in refugees leaving the hospital.[67] In Lebanon, migrants/refugees have been found to be forced to receive health services in public hospitals and select health facilities, resulting in a high rate of non-communicable diseases and great pressure on healthcare capacity.[60,68] Diagnostic examinations

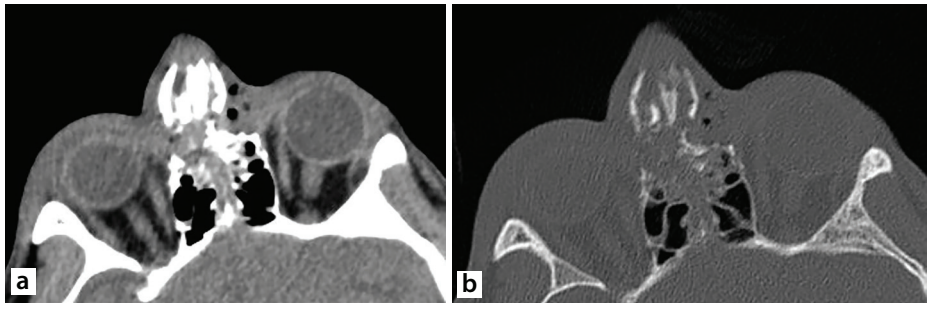


**Figure 7.** A 27-year-old Iranian man suffered blunt facial trauma due to an assault. **(a, b)** Computed tomography images showed perinasal and periorbital soft tissue swelling, with multiple displaced nasal bone fractures.

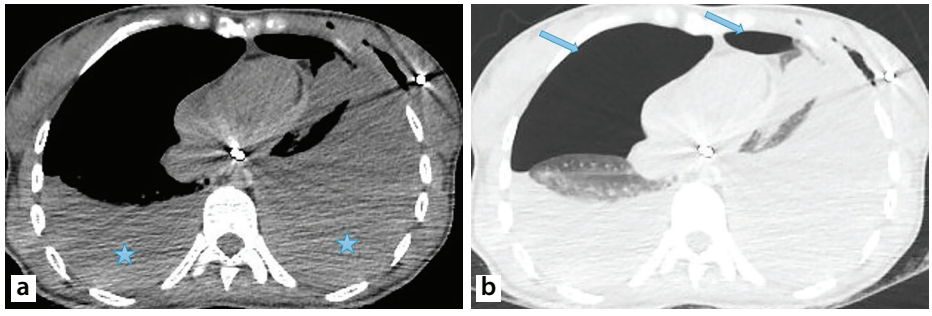


**Figure 8.** A 35-year-old Syrian woman with gunshot wounds was examined postmortem. **(a, b)** Computed tomography scans revealed metallic foreign bodies in the heart and left breast, bilateral hemothorax (stars), and bilateral pneumothorax (arrows), more severe on the right.

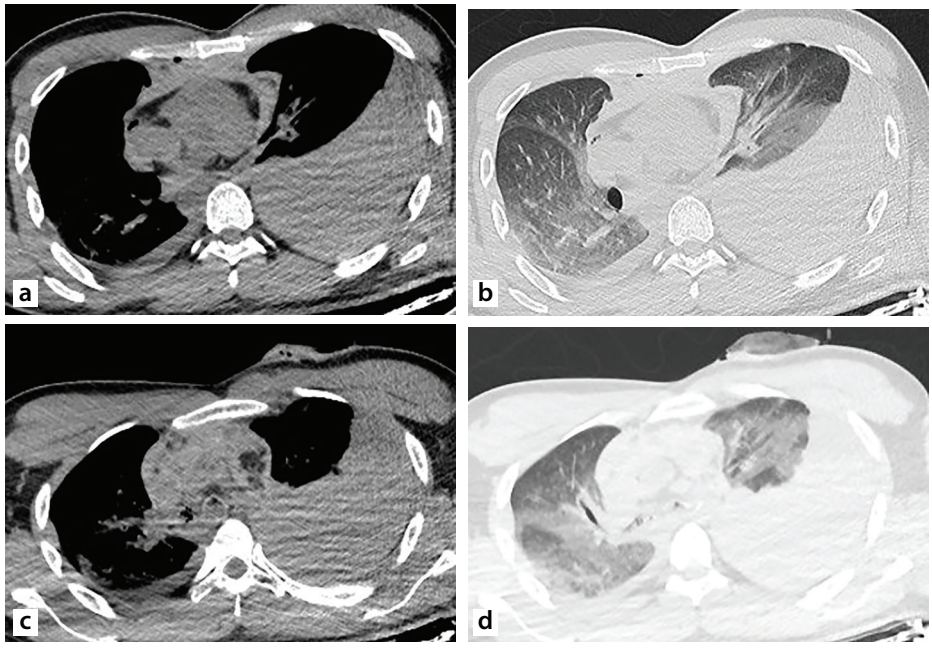


**Figure 9.** A 24-year-old Syrian man sustained a fatal stab wound to the anterior left chest wall. Computed tomography scans showed an anterior mediastinal hematoma **(a)**, bilateral hemothorax, and a defect in the anterior chest wall **(b)**. Retrosternal hematoma **(c)** and millimetric pneumothorax **(d)** were also noted.

may create financial difficulties, particularly among irregular migrants. These financial constraints may also indirectly affect radiological reporting, for example, by reducing the number of follow-up requests or leading to incomplete diagnostic workups.

### Problems with migrant and refugee patients

Many behavioral problems can develop among migrants and refugees, especially those who leave their countries due to violence and war.[69] Problems faced by those working in emergency departments/emergency radiology relating to migrant and refugee patients frequently include psychological problems, cultural problems related to patient privacy, hygiene problems due to a lack of personal self-care, inconsistencies between the clinical histories of migrants and refugees and their past, and distrust of doctors/healthcare personnel and other authority figures. Some immigrants may refuse procedures such as removing clothing for radiological imaging or receiving intravenous contrast agents due to religious beliefs, especially when examined by a radiologist of the opposite sex. Additionally, non-compliance with instructions from radiology staff may occur in individuals with post-traumatic psychological disorders, particularly among those who have migrated from war zones.

### Mass casualty incidents

In cases of mass casualty incidents, such as natural disasters or terrorist attacks in host countries, immigrants are often disproportionately affected due to poorer living conditions. A clear example of this occurred after the earthquake that struck Türkiye and Syria on February 6, 2023, when a shortage of regional radiologists led to emergency radiological reporting being performed via teleradiology.[70]

In conclusion, As long as there are wars and economic hardship, there will be migration. Emergency departments will continue to be used by migrants as their primary source of healthcare in host countries, and the frequency of emergency radiological examinations will increase. Emergency radiologists may encounter privacy-related challenges when evaluating immigrant patients, as well as difficulties in imaging due to communication barriers. Imaging artifacts and incomplete reporting may also occur as a result of insufficient clinical history. It is important for radiology clinics in host countries to know the imaging characteristics of diseases whose frequency increases with migration to increase radiological diagnostic performance.

### Footnotes

### Conflict of interest disclosure

The authors declared no conflicts of interest.

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