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RADIOGRAPHY CLINICAL EDUCATION AMIDST THE COVID-19 PANDEMIC: PERSPECTIVE OF RADIOGRAPHY STUDENTS INTERNATIONALLY

MONITORING OF A SEVERE COVID-19 PATIENT WITH PNEUMOTHORAX COMPLICATIONS THROUGH RADIOLOGICAL AND LABORATORY DIAGNOSIS

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The articles are professional and scientific: results of research, technological assessments, descriptions of cases, etc.

content

Dear colleagues,

It is my pleasure to present the latest issue of the Medical Imaging and Radiotherapy Journal (MIRTJ), Volume 40 (2023). As the new Editor-in-Chief, I am excited to continue the journal's legacy of promoting high-quality research and innovative ideas within the field.
We are pleased to note the increasing diversity of submissions, with manuscripts coming from various countries and covering a wide range of topics. We greatly appreciate your support and encourage you to continue spreading the word about our journal, inviting your colleagues to contribute their research. For slovene authors, we still offer free translations to English to make your path into the world of scientific research and publishing a little bit easier.
As always, MIRTJ remains an open access journal, freely available to all readers through our website and indexed databases. We invite you to explore the latest issue and review the submission guidelines on our website: http://mirtjournal.net/index.php/home.
Thank you for your continued support.

Sincerely,
Alenka Matjašič

Editor-in-Chief
Medical Imaging and Radiotherapy Journal (MIRTJ)

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z veseljem vam predstavljamo najnovejšo številko revije Medical Imaging and Radiotherapy Journal (MIRTJ), letnik 40 (2023). Kot urednica z veseljem nadaljujem tradicijo revije, ki jo le-ta ima na področju spodbujanja kakovostnih raziskav in inovativnih zamisli na širšem področju radiološke tehnologije.
Z veseljem opažamo vse večjo raznolikost prispevkov, saj članki prihajajo iz različnih držav in pokrivajo širok spekter tem. Zelo cenimo vašo podporo in vas spodbujamo, da še naprej promovirate MIRTJ ter povabite tudi kolege, da prispevajo svoje raziskave. Slovenskim avtorjem še vedno ponujamo možnost brezplačnega prevoda članka v angleščino, da vam olajšamo pot v svet znanstvenega raziskovanja in objavljanja.
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S spoštovanjem,
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Urednica revije
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Original article

RADIOGRAPHY CLINICAL EDUCATION AMIDST THE COVID-19 PANDEMIC: PERSPECTIVE OF RADIOGRAPHY STUDENTS INTERNATIONALLY

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ABSTRACT

Purpose: The COVID-19 pandemic has significantly impacted clinical practice. This study explored the impact of the pandemic on diagnostic radiography clinical education from the perspective of radiography students internationally.

Materials and methods: A qualitative approach was used to gain insight into students' experience of clinical placement during the pandemic. A total of sixteen radiography students from six countries were recruited from an international Radiography summer research school. Qualitative data was gathered via three semi-structured focus groups (5-6 students per focus group). Data was analysed using Braun and Clark's phases of thematic analysis.

Results: Five key themes emerged in relation to clinical education during the COVID-19 pandemic, (i) unequal student access to personal protective equipment (PPE) (ii) challenges in achieving clinical learning outcomes (iii) impact of online education on clinical readiness (iv) emotional impact, and (v) coping strategies. Students indicated that they were particularly afraid of transmitting COVID-19 to their family and friends. Some students reported that they felt under pressure to receive COVID-19 vaccinations prior to clinical practice. Others reported confusion with respect to infection control guidelines and application of PPE.

Conclusion: Student radiographers identified key challenges which require consideration by educators to ensure students are appropriately prepared for and supported on clinical placement during a pandemic.

Implications for practice:

- The COVID-19 pandemic has impacted clinical education internationally and this study identifies the implications for radiography students in terms of clinical readiness and their clinical placement experience.
- Simulation-based in-person learning in the X-ray lab and PPE training were perceived by students to be important factors impacting clinical readiness.

INTRODUCTION

On the 5th of January 2020, the World Health Organisation (WHO) reported the emergence of the COVID-19 virus. This highly infectious virus rapidly spread across the world, resulting in a global pandemic (1). A variety of protective measures were introduced in response to the COVID-19 pandemic such as social distancing, mask wearing, contact tracing, travel restrictions and COVID-19 vaccinations. Education traditionally delivered in-person was replaced predominantly with online modes of delivery (2,3). Some critical elements of curricula, such as clinical training of healthcare professionals, could not be delivered online.

Radiography is a healthcare profession that is built upon exposure to learning and practice in the clinical setting. This is key to developing radiography students' competence, reflective practice, and professional identity (4). The pandemic posed several challenges with respect to clinical placements such as lack of staffing for student supervision, altered work patterns, limited physical space for social distancing, and PPE shortages (5,6). Radiography plays an important role in the management of patients with COVID-19. therefore radiographers are considered frontline health professionals likely to be exposed to infectious patients (7). Although not required for diagnosis, imaging (typically chest X-ray or chest CT) is essential for assessing the severity and disease progression of COVID-19 (8). Whilst the frequency of chest imaging increased during the pandemic, the frequency of other radiological examinations decreased due to curtailment of non-urgent healthcare services (6). Some clinical placements were cancelled or postponed as a result (3,6,9). The provision of clinical placements for students in their final year of their degree was prioritised in order to graduate healthcare professionals to join the depleted workforce.

Students' experience in clinical practice can have a significant impact on their learning, professional development, and personal satisfaction (10). Several researchers have investigated radiography students' perspectives of clinical placements during the pandemic using online surveys (2,3,11–13). In a study by Rainford et al, the risk of transmitting COVID-19 to members of the household identified as challenging, as was isolation from family, travel to clinical placements (3). Similarly, Elshami et al and Solís-Barquero et al identified students' primary concern was in relation to transmitting COVID-19 to family members they were living with (3). These studies employed short surveys (designed to be completed in <10 minutes), consisting predominantly of closed-ended questions generating quantitative data. These were advantageous in terms of achieving a high response rate and a wide geographical spread. However qualitative methods of data collection, such as focus groups, are preferable to gain rich, experiential feedback (14). Only two qualitative studies have been conducted on this topic; these studies used semi-structured interviews involving a small sample of UK students (n=9) (15) and new graduates (n=5) (16). These interview-based qualitative studies focussed solely students and newly graduated radiographers in the UK. This study aims to explore the impact of the pandemic on diagnostic radiography clinical education internationally from radiography students' perspectives through the use of focus groups.

MATERIALS AND METHODS

Study design

A qualitative study involving focus groups was conducted to explore the lived experiences and perceptions of student radiographers. Focus groups enable data collection from numerous participants at once and promote rich discussion in a group setting, which can stimulate participants to generate further questions and clarify their views (17). An inductive approach with open-ended questions was used to capture participants' feelings, perceptions, and thoughts. Inductive content analysis was used to explore and develop new themes from the participants experiences of clinical placement during the COVID-19 pandemic

Study participants

A purposive sample was chosen from a reasonably homogenous population of radiography students attending a research summer school in the University of Ljubljana, Slovenia, in August 2022. All radiography students attending this summer school were informed of this research project in person and provided with information leaflets regarding this study. Sixteen radiography students volunteered to participate in this study and were assigned to focus groups of 5-6 students. There were 5 male participants and 11 female participants, ranging in age from 19-30 years of age. Participants were undertaking Radiography degree programmes in the following countries: Switzerland (n=5), Slovenia (n=1), The Netherlands (n=3), Portugal (n=2), Ireland (n=3) and a non-European country (n=2). The non-European country is not named to protect the anonymity of these participants. All students had prior experience of clinical placement; two had completed their first year of Radiography, eight had completed their second year and six had completed their third year of a four-year BSc Radiography degree programme.

Data collection

A neutral room was selected for hosting the focus groups which was spacious enough for participants to be comfortable, yet not so large that it would hinder productive discussion between participants (18). As seen in Figure 1, participants were seated in a semi-circle facing each other to promote an open discussion.

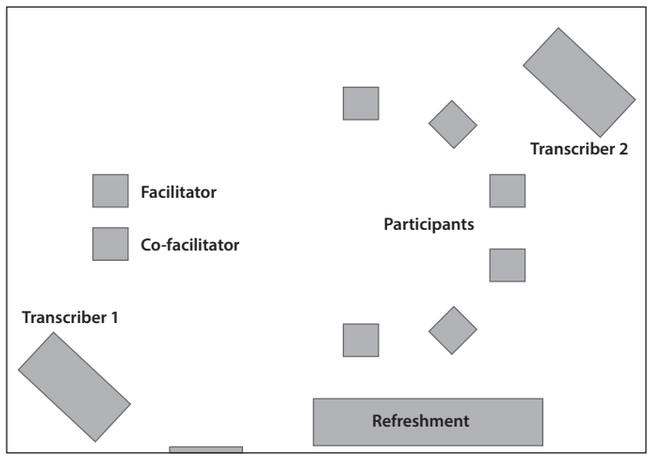

Figure 1: Focus group room organisation

The facilitator led the discussion and asked trigger questions focused around the physical, social, and emotional experiences of participants related to clinical placement during the pandemic e.g. How has it been for you undertaking clinical practice during the pandemic? What have you learned from your experience in clinical practice during the pandemic? What else would you like to share about your placement experience? The co-facilitator adopted a more supportive role in clarifying obscure comments or drawing in participants who haven't contributed. Two transcribers were present so that transcriptions could be compared, merged, and participants approached if there were any discrepancies between transcriptions. To ensure the anonymity and confidentiality of the participants, their names were not used in the transcript. A numerical system was used to code participants for transcriptions. The nationalities of the participants were recorded to identify any country-specific trends in participants' responses.

Data analysis

Each researcher independently coded the final focus group transcriptions using the Braun and Clarke model (19), which is presented in Figure 2. Codes were then revised and refined by all researchers. Finally, common themes were extracted, discussed by the research group, and agreed by consensus.

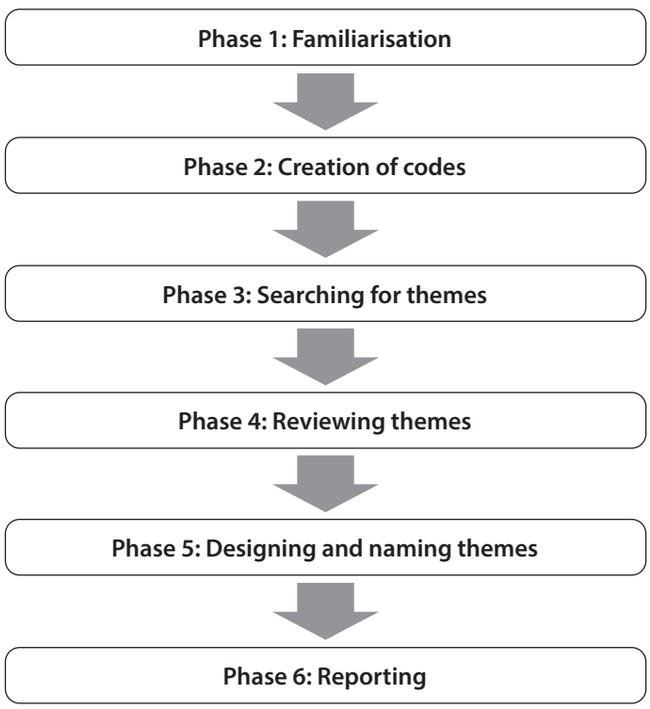

Figure 2: Braun and clarke thematic analysis phases (19)

Ethical considerations

This study received ethical approval from both the lead author's university and the host university. Research was conducted in accordance with the Declaration of Helsinki from the World Medical Association (20). Participation was on a voluntary basis and participants were made aware that they could withdraw from the study if they wished. Researchers adhered to the principles of the General Data Protection Regulations (21). Participant details and any identifying information contained within their responses were de-identified. If participants became upset by the questions the researchers were on hand to offer support.

RESULTS

Clinical placement provision varied during the first wave of COVID-19, with some participants reporting clinical placement postponements, whilst others proceeded with clinical placement. Participants reported feeling pressure from clinical sites and universities to get vaccinated against COVID-19 as many clinical sites did not permit students to practice unvaccinated. Participants felt communication from universities and hospitals in relation to clinical placement rescheduling and pre-clinical requirements could have been clearer and more consistent.

Five main themes emerged in relation to clinical education during the pandemic as depicted in figure 3.

Figure 3: Key themes in relation to radiography clinical education during the pandemic

Unequal access to personal protective equipment (PPE)

Participants who undertook clinical placement in European hospitals reported that PPE was readily available in their clinical sites, whereas those in non-European clinical sites described major issues in relation to PPE shortages in their hospitals. Participants from the non-European country revealed that were instructed by clinical staff to reuse disposable PPE over an extended period of time.

> *"In hospitals, there were financial problems, therefore students given one gown to wear until it tears and then will get another gown. One surgical mask was provided to students every day. We were told to wear PPE for as long as possible but were allowed change gloves" (SR16).*

"In Government hospitals we had to buy our own masks. The hospital was buying the cheaper masks (referring to surgical masks). I was afraid to use them. I bought my own FFP2 mask" (SR7).

Challenges in achieving clinical learning outcomes

Participants discussed several challenges in achieving the prescribed learning outcomes and competencies in clinical practice during the pandemic. They perceived a lack of mentorship and limited exposure to diverse imaging examinations to have hindered their learning opportunities. Worryingly, some participants described scenarios where they were expected to undertake duties of a qualified radiographer without supervision due to the department being short-staffed.

"There was no placement plan. They (radiographers) said, can you do MRI alone as we need to go to the CT? I was alone working in MRI, I had no choice but to learn. They told me that if I was stuck, I could find them in CT. It was difficult for me" (SR6).
"We couldn't learn the things we needed to. It was a bit more restrictive. I was employed as a student and expected to be professional" (SR5).
"At the University hospital I was mostly working in intensive care. Every patient was intubated and I had to X-ray the patients in ICU" (SR7).

Some participants reflected on the onerous infection control measures associated with imaging COVID-19 positive patients, which they felt were time-consuming and exhausting.

"We did all the COVID patients then disinfected the area. We used a UV lamp to look, then left everything clean for the next day and for the regular patients. We needed more time to deal with patients, time to dress up (put on PPE) and undress (take off PPE) for infection control" (SR1).

Some reported confusion over infection control protocols with regards to the application of PPE.

"It was difficult knowing when to wear masks and then rules changed on which masks to wear and when to change them" (SR11).

Some students talked about not being excluded from imaging examinations of COVID-19 positive patients and from busy clinical areas.

"We were not allowed to X-ray COVID patients" (SR15).

Several expressed the sentiment that they did not have enough practical experience during clinical placement to achieve the prescribed competencies.

"We did not have enough clinical practice time" (SR5).

Impact of online education on clinical readiness

Many participants reported that they did not feel adequately prepared to undertake clinical placement during the pandemic. They reported low self-confidence with regards to their practical radiographic skills and knowledge of infection control measures in the clinical setting.

"It was difficult knowing when to wear masks…" (SR11).

Some attributed their lack of confidence in practical radiographic skills to the lack of simulation-based learning in the X-ray skills lab in advance of clinical placement. Travel restrictions in place during the peak of COVID-19 prohibited students from travelling to the campus to attend practical labs.

"If you are motivated, online education was better for learning theory but more challenging for the practical, more human part of the job. I felt less prepared for clinical practice" (SR11).
"We had more image viewing tutorials, but practically I had only touched an X-ray tube twice before placement" (SR12).

Some participants experienced virtual reality (VR) radiography training online prior to clinical placement. These students had mixed opinions on the value of online VR simulation-based learning.

"VR was not realistic enough to prepare us for clinical placement" (SR12).
"I felt more knowledgeable after online study as the recordings meant we could rewatch lectures at our own pace and we could practice (radiographic technique) using VR software" (SR15)

Emotional Impact

Participants reported that they felt fearful undertaking clinical placement during the pandemic. Most participants described their fears of transmitting COVID-19 to family, friends and patients, rather than fear for their own health.

"I was afraid for my family not me" (SR2).
"I was a bit afraid of COVID. I didn't want to live at home during placement as my parents were at risk" (SR10).
"I was a little bit afraid for my father. My mother didn't work, and my father would earn less money if he missed work due to COVID-19" (SR7).
"I lived beside an old man and my aunt so after work before seeing them, I would shower and then keep a social distance and wear a mask. I also got the vaccine. I tried not to give them covid" (SR16).
"I was scared of getting COVID-19 and of giving COVID-19 to patients" (SR5).

Some participants noted that this initial fear subsided as they learnt more about COVID-19 and how to protect themselves and others.

"In the beginning clinical placement was stressful. Everyone made such a big deal. We had to wear PPE and I was afraid to touch people but as time went on, I started to understand covid and became more relaxed" (SR16).

An additional emotional impact participants highlighted was loneliness. Some participants described a sense of isolation associated with online education and a lack of socialisation with peers outside of clinical practice.

"I felt lonely, it was just me in my room with the computer. I was very lonely" (SR6)

Coping Strategies

Some participants described ways that they found for coping with the anxiety and loneliness felt during the pandemic. These coping mechanisms included exercising, spending time outdoors, communicating with family and friends, connecting with peers via media use and engaging in culinary activities.

> *"I went to talk things over with my buddy/ best friend and that helped a lot. I took fresh air. That was very helpful" (SR8).*
> *"Going out cycling with the family helped me to deal with stress" (SR4).*
> *"I got a lot of new hobbies such as cooking and baking cakes" (SR8).*
> *"I was very lonely. We arranged WhatsApp group calls with other students in the class so that we could talk about the course, which was good. It was like I met people" (SR6).*
> *"Teachers made WhatsApp groups. That was helpful" (SR16).*

Participants talked about forming closer relationships with their family members due to the additional time spent at home during the travel restrictions.

> *"We improved our relationships in our family" (SR11).*

DISCUSSION

The aim of this study was to gain an insight into radiography students' experience of clinical education amidst the COVID-19 pandemic. The challenges in achieving clinical learning outcomes and clinical readiness were central themes that emerged across focus groups. The impact of the pandemic extended beyond clinical practice into participants' social and personal lives. Coping strategies used by students to deal with heightened levels of anxiety and isolation were identified.

According to several participants in this study, the transition to online education during the pandemic negatively impacted their clinical readiness. Participants attributed this to the lack of practical X-ray labs in advance of clinical placement. Practical labs and other on-campus learning activities were cancelled for a period in line with COVID-19 related travel restrictions imposed by Governments. This study highlights the importance of simulation-based learning in the X-ray lab in preparing radiography students for clinical practice. Simulation-based learning enhances radiographic knowledge and clinical decision-making skills (22). Some participants experienced online virtual reality (VR) simulation-based learning. These participants had mixed opinions on the benefits of VR learning. The VR software enabled students to practice positioning virtual patients, setting up X-ray equipment and selecting exposure parameters in the virtual environment. However, it did not involve patient communication. Studies have reported the enhancement of student confidence (23,24) and competence through VR learning, with VR deemed as effective as traditional X-ray labs in the development of technical skills proficiency for novice students (25,26). Participants reported that they felt ill-prepared for the 'human' element of the job such as interacting with patients and clinical staff. These soft skills contribute to professionalism and are integral to radiography education (27). Our findings reiterate the importance of incorporating clinical skills lab-based learning into Radiography curricula.

Participants described several difficulties in achieving the prescribed clinical learning outcomes. Lack of supervision and mentorship was at the forefront of these challenges. Participants described scenarios where they were left unsupervised or with minimal supervision due to departmental staff shortages and redeployment of practice educators. Radiographers may have minimised their involvement in student supervision out of fear of the infection risk posed by students (3). Some student radiographers felt that they were relied upon to work as qualified radiographers, which likely contributed to the sense of unpreparedness for clinical practice. A lack of clinical supervision meant students missed out on opportunities to discuss their work performance in a safe environment with qualified radiographers. Students reported confusion over infection control protocols with regards to application of PPE, which could have been clarified through further interaction with supervising radiographers. Feedback on performance in the clinical practice setting is critical for the development of a competent practitioner (28). Students rely on supervising radiographers to observe their practice and provide feedback so that they can modify, develop, and improve their practice. Furthermore, the work undertaken by students in the clinical environment should be monitored by qualified professionals to ensure it meets necessary quality standards (29). Professional supervision is integral to sound clinical governance and should be considered a normal part of working practice in radiography departments (30). Poor or infrequent supervision is a potential trigger for disengagement (31). Radiography students learn professionalism in part through observation of radiographers in practice, particularly in aspects such as patient care and communication skills, ethical behaviour, and technical competence (32). The conflicting demands of care of the patients and student supervision faced by healthcare professionals (28,33) seem to have been exacerbated during the pandemic.

Another key challenge reported by participants was the limited range of radiological examinations they were exposed to during the pandemic. Participants considered this a direct result of the decreased range of imaging examinations performed in hospitals during the pandemic along with the exclusion of students from busy clinical areas. Whilst students garnered lots of experience with portable chest radiography in intensive care units, they reported that they did not feel confident in performing several other radiological examinations due to lack of exposure. With the exception of chest imaging, the frequency of radiological examinations performed during the pandemic decreased due to curtailment of non-urgent healthcare services (6). Participants talked about being excluded from imaging COVID-19 cases and removed from busy clinical areas to minimise the numbers of staff present in line with infection control guidelines. Social distancing was an issue in some clinical areas due to physical

space constraints. Students reported feeling frustration initially as they felt that their learning was compromised from lack of exposure to various imaging modalities but later described an appreciation for the importance of preventing the spread of COVID-19.

One of the key protective measures in preventing spread of COVID-19 in the clinical setting is use of PPE (34). Radiography student participants who undertook clinical placement in European hospitals reported no issues with access to PPE and were surprised to hear the experience of their counterparts who trained in a non-European country. Participants who trained in non-European hospitals described drastic PPE shortages and substandard infection control practice. For example, participants were provided with a single surgical mask and disposable gown and were instructed to wear it for as long as possible regardless of exposure to COVID-19 cases. This contravenes best practice infection control guidelines for dealing with COVID-19 (34). Similar PPE shortages were experienced in many low-income countries during the pandemic (35).

There was confusion amongst the cohort regarding the infection control guidelines related to PPE use. Our findings concur with another international study of student radiographers, in which 66% of students who experienced COVID-19 imaging were confident with PPE use (3). This reinforces the importance of educational institutions and clinical departments providing regular theoretical and practical PPE training for student radiographers. The lack of confidence regarding PPE use likely impacted participants' fears of contracting COVID-19 in clinical placement and transmitting it to friends and family at home. Participants were less concerned about the risk to their own health. Participants in this study were aged 19-30 years, thus were less at risk of the detrimental health effects of COVID-19 that affect older people with underlying health conditions (36). In two large survey-based studies, 87.8% (3) and 95.1% (2) of student radiographers internationally had concerns related to the risk of infecting their family, whereas 62.2% or less were worried about their own health (2,3). The fear of transmitting COVID-19 to vulnerable family members was an emotional burden carried by many participants in this study. Some described that their solutions to this situation was to move out of home and isolate themselves from family members. However, these solutions had ramifications in terms of adding to financial pressures and feelings of isolation experienced by students. These feelings of isolation were compounded by online education (37) and the lack of socialisation with peers outside of clinical practice. Many participants appreciated the opportunity to socialise with their classmates in the clinical setting. Human interactions with clinical staff and patients also alleviated the sense of isolation felt by participants during the pandemic. These were some of the few positives of clinical placement during the pandemic, highlighted by participants.

Fatigue and pressure to be vaccinated negatively impacted participants' clinical placement experience during the pandemic. Some participants raised the issue that they were not permitted to enter clinical placement until they had been vaccinated against COVID-19. This was a contentious matter for participants as some reported concerns regarding the potential side effects of the recently developed COVID-19 vaccination and their preference not to be vaccinated. On the contrary, others reported that being vaccinated allayed some of their fears regarding transmission of COVID-19 to family members. The constant donning and doffing of PPE during clinical placement were deemed exhausting by participants. Occupational burnout in radiography increased during the pandemic (38). Student radiographers are also liable to experience burnout whilst undertaking clinical placement during the pandemic. The risk of burnout amongst student radiographers should be considered by educators, particularly during pandemic times.

A variety of coping strategies were outlined by student radiographers in this study in relation to dealing with the emotional toll of the pandemic. Students reported that their familial relationships strengthened as a result of spending so much time with them during the period of travel restrictions. They felt the routine created by clinical placement along with the opportunity for in-person social interaction were strong positives aspects of clinical placement during the pandemic. Outside of clinical placement, participants adapted by creating their own routine at home, keeping active and engaging in their hobbies e.g., cooking, yoga, and walking. Participants highlighted the value of university support, particularly in the form of regular communication from academic staff.

Limitations

There was a risk that participants for whom English was not their first language wouldn't comprehend questions or would miscommunicate their response. Participants were encouraged to let facilitators know if they didn't understand any information or questions so that these could be rephrased as necessary. This was remediated by participants receiving the trigger questions in a typed format a day in advance of the focus group. Participants were recruited from an international summer research school, delivered through English, and had a high standard of English.

CONCLUSIONS

This study explored the experiences of student radiographers who undertook clinical placement during the COVID-19 pandemic. Student radiographers identified several challenges in relation to their clinical placement. At the forefront of these challenges were lack of supervision, PPE shortages, confusion regarding infection control guidelines and the limited range of radiological examinations performed in clinical practice. Simulation-based learning in the X-ray lab was perceived by students to be important factor influencing clinical readiness. Participants reported that they were particularly worried about passing COVID-19 to friends and family. Students identified strategies for coping with the anxiety and loneliness experienced during the pandemic, such as creating a routine at home, exercising, and using social media to connect with their peers.

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Original article

MONITORING OF A SEVERE COVID-19 PATIENT WITH PNEUMOTHORAX COMPLICATIONS THROUGH RADIOLOGICAL AND LABORATORY DIAGNOSIS

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ABSTRACT

Introduction: Monitoring and treatment of severely ill patients with the coronavirus disease who are on mechanical ventilation due to the severity of the disease with the development of many complications remains a challenge. The increased incidence of pneumothorax in Covid-19 patients on mechanical ventilation may be due to a combination of infection-induced parenchymal injury and inflammatory response with additional positive pressure ventilation.

Materials and methods: In our study, we report a case of a severe Covid-19 patient with a pneumothorax complication through radiological and laboratory diagnostics. The performed radiogram of the lungs was taken each time in the AP projection in a semi-sitting position. A digital mobile X-ray device was used for imaging. All laboratory parameters that were monitored in the patient are performed in the panel of standard routine controls for patients with Covid-19.

Results: The radiogram was better as the administration of therapy and chest drain were effective. Biochemical and hematological parameters are performed, which indicate a decrease in the number in blood count and biochemistry. The patient spent a total of 80 days in the hospital.

Conclusion: Survival of a severe form of Covid-19 infection with the complication of pneumothorax is very rare, but still possible, as shown in our case. A chest radiograph with laboratory monitoring of the condition is of great importance in establishing the diagnosis of Covid-19 infection, and in the final assessment of the patient's condition upon discharge from the hospital.

Keywords: Covid-19, mechanical ventilation, pneumothorax, radiological diagnostics, laboratory diagnostics.

INTRODUCTION

Since December 2019, the discovery of the new coronavirus and the disease Covid-19 remains a challenge in the monitoring and treatment of seriously ill patients who, due to the severity of the disease, are on mechanical ventilation with the development of many complications (1, 2). Covid-19 infection can result in recovery, acute complications, long-term consequences and even death (3). Complications can be related to diseases of the lungs, blood, heart, blood vessels, nervous system, kidneys and liver. One of the rare (but increasingly related) complications for patients with Covid-19 who are on ventilators is pneumothorax. Pneumothorax represents the presence of air in the pleural cavity with or without lung collapse and is often a life-threatening complication of the primary disease (4). While primary, spontaneous pneumothorax can occur without a precipitating event, secondary spontaneous pneumothorax is a complication of the underlying lung disease. Pneumothorax is a rare complication among mechanically ventilated patients, as low tidal volumes are now used instead of traditional high tidal volumes, but the incidence is slightly higher in patients with high positive end-expiratory pressure (PEEP). The incidence of pneumothorax has been observed to increase due to the combination of parenchymal injury caused by infection and the inflammatory response with additional positive pressure ventilation (5). Studies suggest that during the Covid-19 pandemic, the incidence of pneumothorax increased in mechanically ventilated patients with Covid-19 infection, because mechanical ventilation has harmful effects on the lungs, including the development of pneumothorax (6). Reports of spontaneous pneumothorax in patients with Covid-19 suggest that the infection itself could cause pneumothorax in addition to ventilator-induced trauma in mechanically ventilated patients (5, 7). The exact way and how infection with the SARS-CoV-2 virus itself causes pneumothorax is supported by several theories. According to some reports, it is considered that the pathogenesis of pneumothorax in Covid-19 is multifactorial. There are thought to be four key factors in the pathogenesis of pneumothorax. These include the following: increased alveolar pressure, most likely due to recruitment positioning or a plateau pressure (Pplat) of 35 cm H2O or greater; increased negative pleural pressure due to a respiratory rate of 30 per minute or more, severe coughing, forced inhalation, or paradoxical thoracoabdominal movements; alveolar shear stress seen as heterogeneous attenuation or ill-defined infiltrates on chest X-ray; and finally, changes in lung structure and function due to various diseases seen as consolidation, fibrosis, cysts, or emphysema on radiographs (8, 9). According to the available data, there are very few reported cases of pneumothorax as a complication of the Covid-19 disease in severe patients, without the result being a fatal outcome. In our study, we present a case of a severe Covid-19 patient with pneumothorax complications, through radiological and laboratory diagnostics, which resulted in a positive outcome, not fatal.

OBJECTIVE AND METHODS OF WORK

The aim of the paper is to present a rare case of survival of a Covid-19 patient, who was on a ventilator for a long time with the consequences of pneumothorax proven by radiological images and laboratory tests. The radiograph of the lungs was performed each time in the AP projection in a semi-sitting position, with a mobile radiological device. A digital mobile X-ray device (General Medical Merate – MAC D) was used for imaging

Table 1. Hematological parameters of the patient from hospitalization to discharge

Hematological parameters and reference values	First finding	Control finding	Control finding	Control finding
WBC M 4-10x10 ^{9} /L, F 4-10x10 ^{9} /L	6.25 x10 9 /L	9.9 x 10 9 /L	14.9 x 10 9 /L (+)	12.6 x 10 9 /L (+)
RBC M 4.5-6.2x10^{12}/L, F 3.95.20x10^{12}/L	4,20x10^{12}/L (-)	3.37x10^{12}/L (-)	3.19 x10^{12}/L (-)	2.85 x10^{12}/L (-)
HGB M 132-175 g/L, F 120-133 g/L	137 g/L	106 g/L (-)	99 g/L (-)	87 g/L (-)
HCT M 0.40-0.51 L/L, F 0.35-0.47 L/L	0,381 L/L (-)	0.319 L/L (-)	0.310 L/L (-)	0.271 L/L (-)
MCV M 80-96 fL, F 80-96 fL	90,7 fL	94.7 fL (+)	97.2 fL (+)	95.1 fL
MCH M 27-32 pg, F 27-32 pg	32,6 pg (+)	31.5 pg	31.0 pg	30.5 pg
PLT M 140-400X109 / L, F 140400x109 / L	192 x 10 ^{9} /L	332 x 10 ^{9} /L	338 x 10 ^{9} /L	389 x 10 ^{9} /L
LYM%	0.110 (-)	0.101 (-)	0.068 (-)	0.104 (-)
NEUT%	0.824 (+)	0.0804 (+)	0.0880 (+)	0.782 (+)

Source: Patient's health records, edited by the author

with digital panel (cassette). The distance between the source and detector (SDD) was ~100 cm, and the central beam aimed at the middle of the intermammillary line. Exposure parameters were approximately 80–120 kV, and 8–20 mAs, depending on body mass, constitution. No grid was used. All laboratory parameters that were monitored in the patient, were performed in the panel of standard routine controls for patients with Covid-19 at the Covid Department of the Croatian Hospital "Dr. Fr. Mato Nikolić" Nova Bila. Laboratory parameters were performed: ABS on Radiometer ABL 80FLEK-New Technology, hematology on Sysmex 5DIF XN450, and biochemistry on AbotArhitect Plus CI4100. The data are presented with the consent of the Ethics Committee of the Croatian Hospital "Dr. Fr. Mato Nikolić" Nova Bila, and the source of data for this research is the patient's medical record. The collected data were entered into the Microsoft Excel program, where suitable functions and tools for pictorial and tabular presentation of the data were used for data processing.

CASE PRESENTATION

A 49-year-old male was hospitalized at the Pulmonary and TBC Hospital in Travnik in August 2020 due to elevated temperature, a positive PCR test for SARS-CoV-2 and bilateral lung pneumonia. After four days, he was transferred to the Croatian hospital "Dr. Fr. Mato Nikolić" Nova Bila in the Covid ward, due to deterioration of lung function. In the war he was wounded on the right side of the chest. Patient was conscious, oriented, tachypneic, $Sp0_2$ 85%, normotensive on admission. Biochemical and hematological parameters were performed (Tables 1 and 2), which indicated a decrease in the number of erythrocytes, pronounced lymphopenia and neutrophilia with a decrease in creatinine, calcium, iron, UIBCa and TIBCa, and an increase in MCH, chloride, liver enzyme markers ASTa, GGTa and inflammatory markers of CRPa, Ferritin and D-dimer (Er.4.2x10 ^{12} /L, Hct. 0.381 L/L, Lym.0.110 %, Cr. 61 µmol/L, Ca. 1.95 µm, Fe. 10.2 µmol/L, UIBC 11.1 µmol/L, TIBC 21.3 µmol/L, MCH 32.6 pg, Neu 0.0824, Cl 109 mmol/L, AST 43 U/L, GGT 65 U/L, CRP. 173 mg/L, D-dimer 228 ng/mL, ferritin 659.6 ng/mL).

Table 2. Biochemical parameters of the patient from hospitalization to discharge

Biochemical parameters and reference values	First finding	Control finding	Control finding	Control finding
Urea 3.2-7.4 mmol	5.9 mmol/L	7.5 mmol/L	9.5 mmol/L (+)	3.0 mmol/L (+)
Creatinine 64-111 µmol/L	61 µmol/L (-)	50 µmol/L (-)	46 µmol/L (-)	50 µmol/L (-)
Natrium 135-145 mmol/L	140 mmol/L	148 mmol/L (+)	148 mmol/L (+)	137 mmol/L
Potassium 3.5-5.1 mmol/L	4,3 mmol/L	2.7 mmol/L (-)	3.3 mmol/L (-)	3.6 mmol/L
Calcium 2,10-2,55mmol/L	2 mmol/L	1.95 mmol/L (-)	2.09 mmol/L (-)	1.94 mmol/L(-)
Chloride 98-107 mmol/L	109 mmol/L(+)	103 mmol/L	101 mmol/L	98 mmol/L
AST 5-34 U/L	43 U/L (+)	26 U/L (+)	23 U/L (+)	
GGT 12-64 U/L	65 U/L (+)	46 U/L		
CRP 0-5 mg/L	173 mg/L (+)	118 mg/L (+)	193 mg/L (+)	118 mg/L (+)
D-Dimer 0-195 ng/mL	228 ng/mL (+)	14961ng/mL (+)	2157 ng/mL (+)	1431ng/mL (+)
Ferrum 11.6-31.3 µmol/L	10.2 µmol/L (-)	2.1 µmol/L (-)	6.9 µmol/L (-)	
UIBC 49.0-72.0µmol/L	11.1 µmol/L (-)	19 µmol/L (-)	15.1 µmol/L (-)	
TIBC 25.0-54.0 µmol/L	21.3 µmol/L (-)	21.1 µmol/L (-)	22.0 µmol/L (-)	
Ferritin 21.8–274.7 ng/mL	659.6 ng/mL	454.4 ng/mL (+)	1605.9ng/mL (+)	1455.9 ng/m (+)
Glucose 3.9-5.5mmol/L	5.1 mmol/L	5.4 mmol/L	7.1 mmol/L (+)	7.1 mmol/L (+)

Source: Patient's health records, edited by the author

A radiograph of the lungs was taken (Figure 1), which indicates diffuse shadows that completely involve the parenchyma of both lung wings.

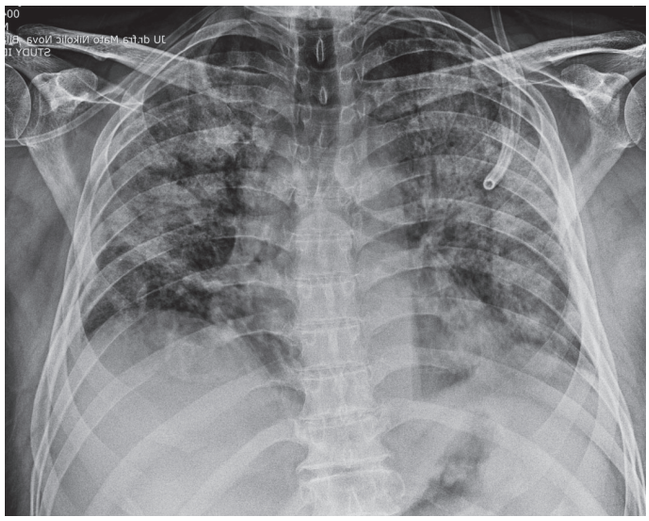

Figure 1. Radiograph of the chest organs after the transfer of the patient (Source: Author)

On the eighth day of the stay in the Covid ward, the patient's respiratory status worsened, the patient was intubated and placed on respiratory support. The performed laboratory tests (Tables 1. and 2.) indicated the progression of the disease and pronounced anemia, lymphocytosis and neutrophilia were recorded, along with elevated values of inflammation markers where erythrocytes, hemoglobin, hematocrit, creatinine, potassium and calcium were also decreased (Er.3.37x10 ^{12} /L Hg.106 g/L, Hct.0.319 L/L, Lym.0.101 %, Cr. 50 µmol/L, K.2.7 µmol/L, Ca. 1.95 µmol/L), while the values of MCVa, urea, sodium, ASTa, CRPa were elevated and extremely high values of D-Dimer and ferritin (MCV.94.7fL, Neu. 0.0804, Ur.7.5 mmol/L, Na.148 mmol /L, AST.26 U/L, CRP.118 mg/L, D-Dimer.14961 ng / mL, ferritin.454.4 ng/mL) were recorded.

On the seventeenth day, the patient was extubated (separated) from the ventilator due to improvement in lung function. The patient was breathing spontaneously on the CPAP (continuous positive airway pressure) mask. On the same day, SpO_2 dropped, and asystole occurred, cardiopulmonary resuscitation measures were started, cardiac action was established, and the patient was intubated again and returned to the ventilator. On the twenty-second day, a tracheotomy was performed, and CPAP ventilation was started. On the thirty-third day, the disease progressed again, and the patient's SpO_2 dropped. A radiograph of the lungs was taken (Figure 2), which still indicated a worsening of inflammatory events in the lung parenchyma, but also an extensive pneumothorax of the left lung wing, which arose spontaneously.

With the progression of the disease and changes in the lung parenchyma, the level of CRP increased, as recorded by laboratory tests (Tables 1 and 2), which continued to support anemia and extremely high values of inflammation markers and D-Dimer as a marker of microcirculatory insufficiency and organ dysfunction in seriously ill patients, with a decrease in erythrocytes, hemoglobin, hematocrit, iron, UIBCa, TIBCa, lymphocytes, creatinine, potassium and calcium (Er. 3.19x10 ^{12} /L, Hg. 99 g/L, Hct. 0.310L/L, Fe. 6.9 µmol/L, UIBC. 15.1 µmol/L, TIBC. 22 µmol/L, Lym. 0.068%, Cr. 46 µmol/L, K. 3.3 µmol/L, Ca. 2.09 µmol/L), while elevated values of leukocytes, MCVa, neutrophils, urea, sodium, ASTa, glucose and extremely high values of CRPa, D-Dimer and ferritin (Le.14.9x10 ^{9} /L, MCV. 97.2fL, Neu. 0, 0880, Ur. 9.5 mmol/L, Na. 148 mmol/L, AST. 23 U/L, Gl. 7.1 mmol/L, CRP. 193 mg/L, D-Dimer. 2157 ng/mL, ferritin.1605.9 ng/mL) persisted.

Thoracic drainage of the left lung was performed, where the respiratory parameters were stabilized. Radiological control was performed, which indicated expansion of the left lung wing (Figure 3.). After stabilizing the patient, we proceed with the extraction of chest drain.

On the thirty-fifth day, a PCR test for SARS-CoV-2 was performed, the result was negative, and the patient was transferred to the Intensive Care Unit (ICU). On two occasions a chest CT was performed, which indicated an abscess collection in the left chest, which was punctured and drained on several occasions until the local findings were repaired.

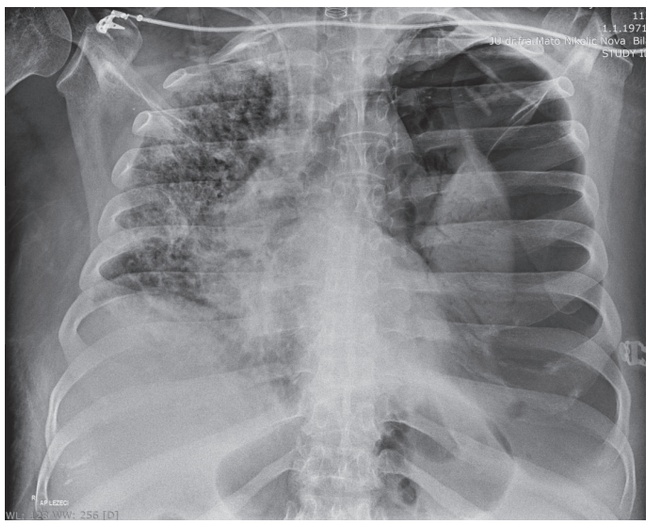

Figure 2. Radiograph of chest organs with pneumothorax (Source: Author)

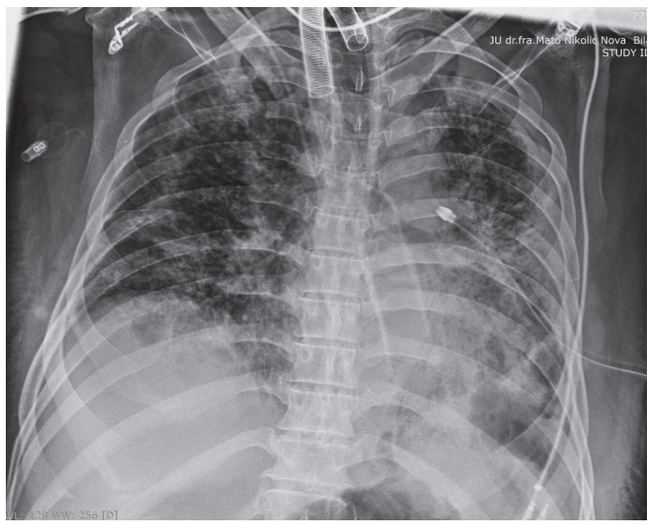

Figure 3. Radiograph of chest organs after chest drain (Source: Author)

On the sixth day of stay in the ICU, the tracheal cannula was removed. The laboratory findings (Tables 1 and 2) indicated the regression of the disease with a decrease in the values of inflammation and microcirculatory insufficiency markers. During the stay in the Covid ward and ICU, antibiotic, thromboprophylaxis medication, sedative, bronchodilator, corticosteroid, anticoagulant, diuretic, albumin, ACE inhibitory, gastroprotective, vitamin and other supportive therapy was included with enteral and parenteral compensation and physical treatment. On the forty-fifth day, the patient was discharged from the ICU, in good general condition, conscious, oriented, self-moving, hemodynamically stable, breathing spontaneously, maintaining proper saturation. The patient was referred for spa therapy and rehabilitation.

DISCUSSION

According to data from the United Kingdom, the mortality rate of patients on mechanical ventilation was 67 % (10). In the United States, reports have shown that 50–67 % of patients admitted to intensive care and 71–75 % of those on invasive mechanical ventilation died (11). The exact pathogenesis of pneumothorax in patients with Covid-19 is not fully understood, and a significant part of the difficulty arises from how rarely it occurs, as only 1 % of all hospitalized patients with Covid-19 develop this complication. In the literature, structural changes in the lung parenchyma caused by Covid-19 may increase the likelihood of spontaneous pneumothorax (12). The consequence of spontaneous pneumothorax can also be type II pneumocyte disorder as a predisposition for spontaneous pneumothorax in Covid-19 disease. Because the virus enters cells via angiotensin-converting enzyme-2, which is abundant in type II alveolar cells (13). In addition to synthesizing surfactants, another critical role of type II pneumocytes is to mitigate damage by facilitating the regeneration of the alveolar epithelium after injury. Disruption of these cells prevents tissue turnover and regeneration, which serves as a focal point for cysts and scars (14). However, the use of respirators in this disease can be another reason behind the formation of lung cysts in patients affected by this virus, which can be a consequence of pneumothorax. Therefore, it is difficult to discern the exact cause of pneumothorax in an intubated patient with Covid-19 (15). Given that Covid-19 is a new disease without specific disease management guidelines regarding mechanical ventilation parameters, intensivists should be especially cautious while maintaining PEEP (positive end-expiratory pressure) in such patients and every effort should be made to prevent pneumothorax in patients with Covid. However, patients can rapidly progress to worsening respiratory failure due to ARDS (acute respiratory distress syndrome), which can make identification of a pneumothorax difficult. Therefore, early imaging with CXR or on-site ultrasound can aid in prompt diagnosis leading to earlier treatment and hopefully a better outcome for the patient (16).

Conclusion

Survival of a severe form of Covid-19 infection with the complication of pneumothorax is very rare, but still possible, as shown in our case. Medical personnel supervising the treatment of such patients should be aware that pneumothorax may develop due to complications caused by the SARS-CoV-2 virus. Diagnosis is based on epidemiological history, clinical examination, laboratory and radiological diagnostic tests. A chest radiograph with laboratory monitoring of the condition is of great importance in establishing the diagnosis of Covid-19 infection, monitoring the progression of the disease and the success of the therapy, and in the final assessment of the patient's condition upon discharge from the hospital. The development of pneumothorax during infection with coronavirus is considered a bad prognostic marker, but in our case, with timely therapy and diagnostics, it passed without complications or death.

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Original article

RADIOGRAPHERS AND EMPATHY - A LITERATURE REVIEW

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ABSTRACT

Purpose: The purpose of this paper was to introduce the concept of empathy in the radiographer profession. We explored why empathy is an important component of the radiographer, the positive impact of empathy on patients and radiographers, the negative impact of empathy on radiographers, how to introduce empathy into the workplace, and what influence the expression or non-expression of empathy has on radiographers.

Materials and methods: We searched for the following keywords: empathy, emotional labour, radiological engineer, empathy, radiographer, radiologic technologist, burnout in radiography. Articles published from 1991 onwards were considered and only articles in Slovene and English with full text availability were included.

Results: 13 articles were included in the analysis, which are summarised in a table. Empathy is a fundamental tool for building a therapeutic relationship between radiographers and patients and contributes to a better diagnostic quality of the examination. Empathy has a positive influence on therapeutic outcomes and on radiographers, as it can help to reduce stress and burnout in the workplace and improve the quality of life of professionals. However, constant exposure to stressful and emotionally difficult situations can have emotional and motivational consequences, such as empathic anxiety and personal distress. Understanding patients' emotions, opinions and experiences, helps radiographers to assess their needs and act accordingly.

Conclusion: Empathy plays an important role in the work of radiographers as it contributes to a better relationship with the patient and helps to improve the diagnostic and therapeutic quality of the examination.

Keywords: empathic care, burnout, empathic training, radiographers

INTRODUCTION

The topic of this paper is radiographers' encounters with empathy in their work. The aim is to present aspects of empathy in the work of radiographers to both the profession and the general public. We have explored how empathy is an important component in the work of a radiographer and how it affects them and the patient.

The terms empathy, sympathy and compassion are very similar to each other and are often used without clear distinctions, but they also share common elements such as generosity, kindness and patient-centredness (Jeffrey, 2016). Authors Zölzer & Zölzer (2022) present empathy as the ability to immerse oneself in the experiences, perspectives and contexts of others. They define it as a skill that someone may or may not have, but nevertheless is not a barrier, as research has shown that empathy can be learned.

Empathy is strongly linked to optimism and a joy for life. This results in a deep and intense connection with others (Juul et al., 2017). At the same time, an empathic relationship between the patient and the radiographer supports the patient's autonomy by allowing them to participate in their treatment. In a sense, empathy is also seeing the world from the patient's perspective (Jeffrey, 2016). As every patient deserves genuine communication, understanding and listening, it is important that radiographers have developed empathy that enables them to understand the patient's situation and potential distress. To be able to practice empathic communication, theoretical knowledge and personality training are needed, which must be sustained over a long period of time. The ability to express empathy is the beginning of helping others (Knuplež, 2015). Empathy cannot be deepened by reading books alone, nor can these skills and knowledge be transferred through lectures alone. It is strengthened when one builds life satisfaction and optimism (Juul et al., 2017).

METHODS

A literature review was performed. Literature was retrieved from Mendeley, ScienceDirect, RUL, PubMed and ResearchGate databases. Articles published since 1991 were used. English articles were found using the keywords 'empathy', 'emotive work', and 'radiological engineer', and English articles were found using the keywords 'empathy', 'radiographer', 'radiologic technologist', 'empathic concern', and 'radiography'. After a brief review of the titles and abstracts, articles that reviewed empathy, radiological technologists, professional burnout and fatigue, and learning to empathise were selected. The search included articles written in both English and Slovenian. We excluded studies that dealt exclusively with stress in healthcare.

The results included articles that described empathy in more detail, its positive impact on radiographers and patients, the negative aspects of empathy on the work of radiographers and how to introduce empathy into their work. To facilitate the review, an organigram, shown in Figure 1, and a table were created that contained information such as the title of the article, authors, year of publication, keywords, what the article explored and what they found.

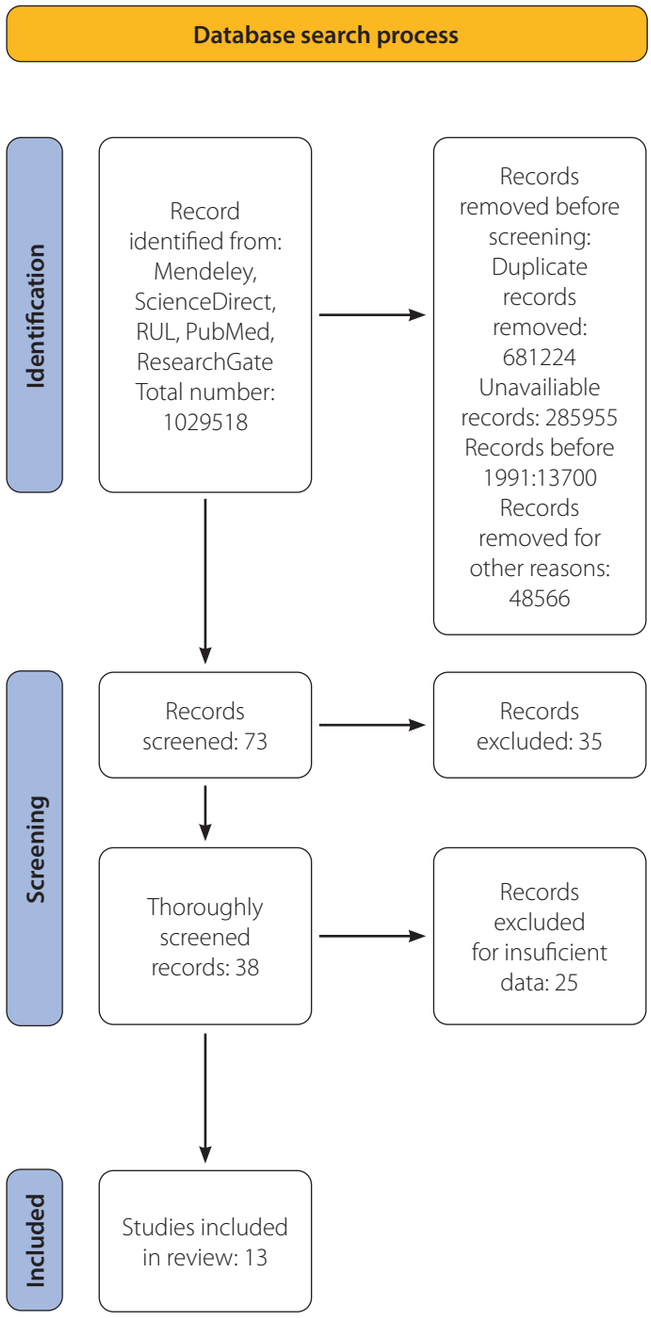

Figure 1: Flow diagram of research process

RESULTS

32 topic-related studies were analysed and 13 of those were included in literature review, as presented in Table 1. Those 13 were analysed in detail and compared to avaliable literature.

Article title	Authors	Publishing year	Keywords	Topic	Main findings
Patient-radiographer communication in primary care (Komuniciranje med bolnikom in inženirjem radiologije v osnovnem zdravstvenem varstvu)	Majda Zupanič	2002	Communication, radiographer, patient	The importance of communication between radiographers and patients is highlighted, as well as the process of their work as radiographers.	The paper concludes that proper communication is a prerequisite for a radiographer to work successfully with patients. Communication is a lifelong learning process. People communicate in different ways, such as: verbally through spoken or written messages and non-verbally through body language, smell, touch, time, space and objects.
The emotional labour of radiographers (Emocionalno delo radioloških inženirjev)	Klelija Štrancar	2002	Emotional labour, radiographer, working conditions, empathy, patient	Research on the emotional labour of radiographers, and the working conditions in which theyrs do or do not show emotionality.	The study showed that emotional labour is linked to the working conditions in which radiographers provide their services. It also depends on the personality of the individual and the length of service.
What is clinical empathy?	Jodi Halpern	2003	Patient, nursing, empathy	What is empathy in healthcare, how empathy affects patients, why is empathy important in the doctor-patient relationship.	If patients feel that doctors are empathetic, they trust such doctors. Empathy facilitates trust and disclosure by patients.
Physicians down-regulate their pain empathy response: An event-related brain potential study	Jean Decety, Chia-Yan Yang, Yawei Cheng	2010	Empathy, pain, emotion regulation, doctor	Testing the response of doctors and a group of people (non-healthcare professionals) to seeing patients in pain and patients without pain.	Research has shown that caring for people in pain triggers a kind of empathy response in the observer. Managing empathy towards patients is crucial for both doctors and other healthcare professionals who regularly encounter people in distress in their work. It is important that health workers' emotional reactions do not interfere with the effectiveness of their work and do not affect their well-being.
Challenges Faced by Radiography Students During Clinical Training	Kofi Adesi Kyei, William K. Antwi, Kwabena Bamfo-Quaicoe	2015	Clinical training, skills development	Respondents reported on the relationship between theory and practice, suggestions for improving clinical experience.	The lack of appropriate clinical practice in these areas has a major impact on the delivery of quality healthcare.
Relationships between nurses' empathy, self-compassion and dimensions of professional quality of life: a cross-sectional study	Joana Duarte, José Pinto-Gouveia, Bárbara Cruz	2016	Empathy, nurses, self-compassion, compassion fatigue	To explore how empathy and self-compassion relate to occupational quality of life.	The results suggest that perspective-taking, empathic concern, personal distress and attentiveness are closely related to empathy satisfaction. The study also found that personal distress, empathic concern and self-judgement are related to compassion fatigue and burnout.

Article title	Authors	Publishing year	Keywords	Topic	Main findings
Learning empathy through virtual reality: Multiple strategies for training empathy-related abilities using body ownership illusions in embodied virtual reality	Philippe Bertrand, Jérôme Guegan, Léonore Robieux, Cade Andrew McCall, Franck Zenasni	2018	Learning and training empathy	Which empathy skills need to be improved, what are good training strategies to improve these skills, the best use of virtual reality to improve these skills.	Strategies for teaching empathy (SEL, constructivism, safe environment for positive intergroup reactions), training methods (role-play, mindfulness, implementation of egalitarian goals).
Emotional impact and compassion fatigue in oncology nurses: Results of a multicenter study	Esther Arimon-Pagès, Joan Torres-Puig-Gros, Paz Fernández-Ortega, Jaume Canela-Soler	2019	Oncology nurses, compassion fatigue, burnout, secondary traumatic stress, anxiety	Assessment of empathy satisfaction, empathy fatigue and anxiety in oncology nurses, and association with demographics, training, working conditions and psychological factors.	A high percentage of nurses experience burnout, anxiety and empathy fatigue in their work. Many feel that training in emotional management is needed.
The role of empathy in health and social care professionals	Maria Moudatsou, Areti Stavropoulou, Anastas Philalithis, Sofia Koukouli	2020	Empathy, health professionals, therapeutic relationship	The concept of empathy was analysed to highlight its importance for health professionals; what empathy means, the role and importance of empathy in the health professions for the patient, tools for assessing empathy, what factors influence empathy.	An empathic attitude enhances cooperation, increases patient satisfaction, improves the quality of care, eliminates errors; education contributes greatly to improving the therapeutic relationship.
Empathy and Communication in Medical Imaging	Patricia Gregson	2020	Empatija, slikanje	Vpliv empatije in komunikacije na diagnostični rentgenski poseg.	Komunikacija in empatija sta ključnega pomena; boljše razumevanje pacientove situacije izboljša kakovost slike.
Empathy in Medicine: What It Is, and How Much We Really Need It	Jean Decety	2020	Compassion, empathy	Introduce theory by teaching empirical knowledge from research on empathy.	Empathy is evoked differently in healthcare professionals than in patients. Empathy is one of the essential components of the therapeutic relationship, as it has a positive impact on the patient and, to a certain extent, on the healthcare professional.
Communication and empathy skills: Essential requisites for patient-centered radiology care	Robert M. Kwee, Thomas C. Kwee	2021	Radiologists, radiology	How patients value radiologists in the Netherlands (online evaluation).	It is desirable to include communication training in the specialisation of radiologists.
The role of empathy in ethics of radiological protection	Friedo Zölzer, Neysan Zölzer	2022	Moral values, radiological protection	Ethical foundations of radiological protection, the role of empathy, empathy in practice	Empathy can be learned; it is expected to be respected by people working in healthcare - a moral concept. Empathy is used in different disciplines. The importance of communication about the risk of radiation.

DISCUSSION

The aim of this article was to introduce the concept of empathy and the actions of radiographers in relation to empathy. It was described in detail why empathy is an important component of radiographers, the positive impact of empathy on patients and radiographers, the negative impact of empathy on radiographers, how to introduce empathy into the workplace, and what influences the possible non-expression of empathy at work. Many studies present empathy as an important component for radiographers and healthcare professionals in general.

Why is empathy an important component of a radiographer?

Patients who come for radiological diagnostics may be ill, burdened with fears, distresses and desires. Special patient groups include deaf and blind people, the elderly, the disabled, children and mentally unstable patients. All these special groups require even more flexibility, resourcefulness and attention, and above all emotional stability, than other patients. The medical environment is unfamiliar to the patient, so he or she should not be expected to behave in the way the radiographers want without prior explanation. Radiographers need to perform a diagnostic or therapeutic examination in a technically appropriate manner, and patients also need a friendly welcome and attitude (Zupanič, 2002).

According to Štrancar (2002), emotional labor is crucial for radiographers, who must build a connection with patients while ensuring diagnostic accuracy and safety. They face challenges such as keeping patients still during imaging, particularly with children or restless and confused individuals. Operating X-ray machines requires both physical and mental prowess, including quick thinking and adaptability. Radiographers aim for efficient, high-quality imaging while navigating patients' diverse conditions and behaviours. The profession requires communication, leadership skills, empathy and medical aptitude for dealing with ionizing radiation. Empathy is recognized as vital for effective radiography, influencing both patient outcomes and the radiographer's experience (Štrancar, 2002).

All patients want genuine communication, listening and understanding from healthcare staff. Radiographers and other healthcare professionals need to develop empathy to understand the patient's situation (Knuplež, 2015). In their article, Zölzer & Zölzer, (2022) suggest that the needs and requires of those affected should be taken seriously from the very beginning of the diagnosis and treatment process. People's perceptions should not be ignored if a holistic understanding of the whole situation is to be achieved. Without empathy, the work would be severely limited in terms of harmlessness and solidarity. The assessment of radiological situations and health problems must be based on empathy. In a study (Jagodič et al., 2020) it was found that rapid technological development requires highly skilled and empathetic professionals. Radiographers also play an important role in the therapeutic part of treatment.

The positive impact of empathy on patients and radiographers

The positive impact of empathy, both on the patient and on healthcare professionals, is often discussed. Authors, such as Moudatsou and Gregson, state that empathy is an important communication skill for the healthcare professional. It enables the development of a therapeutic relationship with the patient and has a positive impact on the work of the radiographer and the patients' feelings (Moudatsou et al., 2020). Empathy deepens and shapes the relationship between the patient and the radiographer and helps to reduce any anxiety experienced by patients (Gregson, 2020).

Moudatsou and colleagues (2020) present empathy as the ability to understand the patient experience without relating to the patient. It is a central concept that enables the development of a therapeutic relationship with the patient, and this forms the basis for therapeutic change. Empathy has been shown to have a positive impact on therapy outcomes. Case studies of groups of patients with different illnesses have shown positive results regarding the progress of treatment in relation to empathy. In studies of patients with diabetes, a link between empathy and a positive course of treatment for the disease has been found. Oncology patients are less affected by stress, show less aggression and are less likely to experience depression (Moudatsou et al., 2020).

Empathy fosters trust and openness, easing patient anxiety and aiding coping with bad news (Halpern, 2003). It supports patient autonomy, encouraging participation in decision-making (Jeffrey, 2016), and acknowledges patients as individuals (Zupanič, 2002). Understanding and empathetic communication improve patient compliance (Knuplež, 2015). Healthcare professionals, including radiographers, recognize the importance of emotional support, particularly for children and the elderly (Štrancar, 2002). Empathy enhances patient care, facilitating smoother interactions and preparation (Zupanič, 2002). Clear communication and empathy lead to better care, reduced radiation exposure, and enhanced patient satisfaction (Gregson, 2020).

The negative impact of empathy

Although empathy is one of the core values in healthcare, it can have detrimental consequences if not properly balanced and controlled (Duarte et al., 2016). It involves somatic sensorimotor signals in pain processing areas between the observer and the observed person, which can trigger empathic concern and feelings of sympathy. But attention must also be paid to the fact that the same signals can pose a threat to the individual, in the form of personal distress manifesting as anxiety and feelings of discomfort. When observing and imagining people experiencing pain, the central nervous system pain matrix of the observer is activated, and this can lead to personal distress and compassion fatigue and burnout (Decety et al., 2010). Bertrand and colleagues (2018) confirmed the facts that empathy creates an identified response to the patient's emotions, which can cause extreme distress for the radiographer. This phenomenon is called empathic distress and very likely leads to burnout. Also, Moudastou and colleagues (2020) in their article highlighted the problem of

fatigue due to prolonged exposure to stress, in expressing and experiencing empathy.

Many studies have reported the vulnerability of radiographers, as they are constantly exposed to difficult situations such as illness, suffering and death in their profession, leading to a greater susceptibility to developing occupational stress, especially if they are not skilled in effective empathic regulation. In such cases, several physical and mental health problems such as depression, anxiety and low self-esteem arise. In addition to these health problems, stress and burnout are also factors that affect professional performance and are associated with suboptimal patient care and the occurrence of professional errors. Objective errors are consequently followed by a deteriorated attitude towards patients (Duarte et al., 2016). Štrancar (2002) also found in her study that radiographers who have children of their own become more sensitive to the emergence of empathy with more years of service. It is essential that the emotional response of radiographers does not affect the quality and effectiveness of their work (Decety et al., 2010).

How to put empathy to work?

There are different strategies for teaching empathy. SEL (learning in educational contexts) is social and emotional learning that enables people to identify and manage their emotions, motivations and social relationships. It also allows learning, modelling and practising these skills. SEL is implemented on the basis of long-term training. Constructivism always includes cooperative tasks. It combines a range of approaches and methodologies that dictate how to learn and develop emotionally, cognitively and socially. A safe environment for positive inter-group interactions fosters positive relationships between groups, focused on the same common goals and cooperation. Stereotyping and expressions of prejudice are reduced. The phenomena associated with empathy are key to successful social interactions, as they allow for better understanding of each other, learning from the actions of others, and ultimately providing help (Bertrand et al., 2018).

Radiology constantly evolves, requiring radiographers to regularly update their skills through training courses (Milanović et al., 2013). Moudatsou et al. (2020) emphasize lifelong empathic skill development for healthcare professionals, highlighting education's role in fostering empathy and improving patient care. Understanding patients' needs is essential, requiring developed empathic skills. Clinical training is crucial for radiological technology students' competency (Kyei et al., 2015; Mason, 2006). In the USA, empathy education significantly enhances therapeutic relationships and professionals' ability to perceive patients' feelings (Moudatsou et al.). Various methods, including practical work and role-play, can facilitate empathy education. While empathy can be learned, some find it easier than others (Zölzer & Zölzer, 2022). Communication training is vital in radiology specialties, as patients value it highly (Kwee & Kwee, 2021). Radiological societies can promote communication skills training for radiographers as part of their professional development.

CONCLUSION

This article highlights the crucial role of empathy in the field of radiography and explores its significance, implications, and challenges. It highlights why empathy is a cornerstone for radiographers and the profound impact it has on both patients and professionals. The article emphasizes the need for radiographers to cultivate empathic skills amidst the multiple challenges posed by diverse patient populations and the evolving healthcare landscape.

This study focuses attention on the positive impact of empathy, illustrating that it promotes trust, reduces anxiety and improves patient outcomes. It also highlights the role of empathy in strengthening therapeutic relationships, improving patient compliance and enhancing the overall quality of care. However, the article also presents the potential pitfalls of empathy and warns that its uncontrolled expression leads to burnout and compassion fatigue in radiographers.

There are different strategies for integrating empathy into radiology practice and professionals should be encouraged to engage in lifelong learning and continuous professional development. The importance of empathy education, clinical training, and improving communication skills in preparing radiographers for the dynamic healthcare environment should also not be overlooked.

Empathy is not only an essential trait, but a fundamental competency for radiographers that is necessary to manage the complexity of patient care and ensure optimal outcomes. By recognizing and applying the power of empathy, radiographers can improve the standard of care, promote meaningful patient interactions, and contribute to the holistic well-being of patients and practitioners alike.

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KAJ PA ZAŠČITA?

PRI RADIOLOŠKIH PREISKAVAH NE UPORABLJAMO VEČ SVINČENE ZAŠČITE

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