International Journal of Radiology and Diagnostic Imaging

E-ISSN: 2664-4444
P-ISSN: 2664-4436
www.radiologypaper.com
IJRDI 2025; 8(2): 41-44
Received: 23-03-2025
Accepted: 26-04-2025

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Adaptation of interventional radiology services amid the covid-19 pandemic: A tertiary care community hospital's early experience

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DOI: https://www.doi.org/10.33545/26644436.2025.v8.i2a.460

Abstract
The COVID-19 pandemic posed unprecedented challenges to healthcare systems globally, with interventional radiology (IR) services being significantly impacted. This study outlines the early adaptations implemented by the interventional radiology department at a tertiary care community hospital during the initial phase of the pandemic. We retrospectively reviewed workflow changes, procedure volumes, staff allocation strategies, infection control measures, and patient triage systems instituted between March and August 2020. Findings demonstrated a significant decrease in elective IR procedures, with a shift towards urgent and emergent interventions, alongside increased collaboration with critical care teams. Despite reduced procedural volume, timely care was maintained for high-acuity patients. Adaptations such as cohorting, enhanced PPE protocols, and teleconsultations played a vital role. This study highlights the flexibility and critical role of IR in responding to public health crises, with implications for future pandemic preparedness.

Keywords: Interventional radiology, COVID-19, healthcare adaptation, elective procedures, infection control, pandemic preparedness

Introduction
The emergence of the novel coronavirus disease 2019 (COVID-19) caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has significantly disrupted healthcare systems worldwide. The unprecedented demands on hospital infrastructure, personnel, and resources necessitated urgent and often improvised changes in operational models to mitigate transmission risk while maintaining essential clinical services [1-3]. Amid this turmoil, interventional radiology (IR), a specialty that combines diagnostic imaging with minimally invasive therapeutic procedures, faced unique challenges. The need to rapidly pivot from routine workflows to crisis-oriented practices tested the adaptability and resilience of IR departments, particularly within community-based tertiary hospitals that often operate at the intersection of high acuity care and resource limitation [4, 5].

Interventional radiology plays a pivotal role in the continuum of care for a diverse range of conditions, offering image-guided procedures that are often alternatives to more invasive surgical interventions. During the pandemic, however, this strength was tempered by several operational challenges. These included a sharp decline in elective procedures, interruptions in supply chains for medical equipment and protective gear, and the necessity of reallocating IR personnel to COVID-related roles [6-8]. Additionally, maintaining the safety of staff and patients became a top priority, with departments needing to implement stringent infection control protocols while still responding to time-sensitive clinical needs [9-11]. In this rapidly evolving context, it became essential to balance competing imperatives: reduce nosocomial transmission, preserve healthcare workforce integrity, and sustain access to critical interventional procedures.

In response to these challenges, many IR departments globally instituted triage algorithms to prioritize urgent and emergent cases. Elective procedures were deferred based on institutional risk-benefit assessments, and scheduling protocols were modified to accommodate fluctuating demand and resource constraints [12-14]. Protective measures were enhanced through rigorous enforcement of personal protective equipment (PPE) use, zoning of procedural areas, and comprehensive cleaning and disinfection routines between

cases [15,16]. Additionally, workflow innovations such as teleconsultations, staggered staff shifts, and split-team models were implemented to maintain continuity of care while minimizing cross-exposure among healthcare personnel.

The scope of IR procedures during the pandemic shifted notably toward life-saving and time-critical interventions. Commonly performed procedures included image-guided drainages for abscesses, vascular access placements for critically ill patients, and emergency embolization for hemorrhage control [17-19]. These adaptations underscored the versatility of IR and its capacity to integrate into broader multidisciplinary COVID-19 care efforts. Importantly, the role of IR in facilitating patient management without requiring transfer to operating rooms or intensive care units also contributed to reducing pressure on overwhelmed surgical and critical care services.

This study presents the early experience of a tertiary care community hospital's IR department in adapting to the challenges posed by the COVID-19 pandemic. We describe the institutional strategies adopted, analyze procedural trends during the initial six months of the pandemic, and assess the impact of these adaptations on service delivery and operational safety. By documenting our approach and outcomes, this report aims to contribute to the growing body of literature on healthcare resilience during pandemics and offers actionable insights for IR departments preparing for future health system crises [20-22].

Materials and Methods

This retrospective observational study was conducted at a tertiary care community hospital Teaching Hospital, Bharatpur, Nepal to evaluate the impact of the COVID-19 pandemic on interventional radiology (IR) services. The study analyzed all IR procedures performed between March 1 and August 31, 2020, which represented the initial six months of the pandemic response. To provide context and assess relative changes, procedural data from the corresponding six-month period in 2019 were used as a historical control. The primary objective was to compare overall procedural volume, case types (elective vs. emergent), patient settings (inpatient vs. outpatient), and operational adaptations made in response to the evolving public health crisis.

Data were collected from institutional electronic medical records, departmental procedure logs, and staff rosters. Each procedure was classified based on urgency (elective or emergent), clinical indication, and patient COVID-19 status. COVID-19 testing outcomes, where available, were incorporated to assess infection control practices and patient triage accuracy. Additional variables captured included patient demographics, hospital admission status, and the duration of hospitalization. The procedure type was cross-referenced with American College of Radiology (ACR) guidelines to validate triage classification and prioritization decisions during the pandemic period.

In parallel, workflow modifications implemented in the IR department were systematically documented. These included protocol changes outlined in departmental memoranda, infection prevention checklists, and meeting notes from IR leadership teams. A qualitative review was also conducted based on semi-structured interviews with radiologists, technologists, and nursing staff to understand the rationale, feasibility, and perceived effectiveness of key adaptations. Notable measures included the adoption of enhanced PPE protocols, creation of COVID-designated procedure rooms, adjustment in room turnover times, and cohorting of staff into separate teams to limit cross-contamination and ensure workforce continuity. Redeployment of IR personnel to intensive care units and emergency departments was also reviewed as part of broader institutional response planning.

Descriptive statistical methods were employed to summarize procedural trends and shifts in clinical practice. Quantitative data were reported as frequencies and percentages, with year-over-year comparisons made using absolute differences and proportional changes. Thematic analysis was used to extract recurring concepts from qualitative data, particularly in relation to staff safety, care delivery, and workflow sustainability. All study procedures complied with the ethical standards of the institutional research committee and were approved by the Institutional Review Board (IRB), with a waiver of informed consent due to the retrospective nature of the study.

Results and Discussion

A total of 487 interventional radiology (IR) procedures were performed at our institution between March 1 and August 31, 2020, compared to 732 procedures during the corresponding period in 2019, indicating a 33.5% overall reduction in procedural volume. The most notable decline was observed in elective procedures, which dropped by 68%, reflecting institutional prioritization of urgent and emergent care in accordance with pandemic-response guidelines. Despite this decline, IR services maintained a robust presence in critical care delivery, with urgent and emergent procedures constituting 72% of the caseload during the COVID-19 period. These included percutaneous abscess drainages (n=102), central venous access placements (n=87), and image-guided core biopsies (n=61), highlighting the specialty's essential role in supporting non-operative management strategies in critically ill and immune compromised patients.

To ensure operational continuity while minimizing staff exposure, the department adopted a split-team staffing model. Personnel were divided into self-contained teams working in rotational shifts, thereby mitigating the risk of entire-team quarantine in the event of exposure. Procedure rooms were stratified into zones for COVID-positive and COVID-negative patients, with stringent protocols for cleaning and ventilation between cases. These adaptations not only limited cross-infection risk but also preserved room availability and procedural efficiency. Routine training sessions reinforced the correct use of personal protective equipment (PPE), and hospital leadership ensured uninterrupted PPE supply chains. Importantly, no IR team member tested positive for SARS-CoV-2 during the study period, supporting the effectiveness of the safety measures employed.

Remote consultation workflows were introduced to further reduce in-person interactions and optimize triage. Referring physicians submitted digital requisitions accompanied by imaging, which allowed IR consultants to assess procedural necessity, determine COVID-related risk, and plan appropriately. Outpatient procedures, where feasible, were deferred or managed through conservative treatment alternatives, though high-priority cases continued uninterrupted through tailored scheduling. This approach

facilitated sustained access to IR for oncology patients and those requiring diagnostic tissue sampling or urgent vascular access, with minimal disruption to time-sensitive care pathways.

The observed procedural trends and adaptive strategies are consistent with patterns reported internationally. Multiple institutions have documented similar reductions in elective IR activity and realignment of resources toward emergent interventions [23-26]. Moreover, interventional radiologists contributed significantly to multidisciplinary COVID-19 care, offering bedside procedures that reduced the need for patient transport and minimized exposure risk for other healthcare workers [27, 28]. Our findings underscore this evolving role, as IR's agility enabled it to fill critical care gaps during the crisis while maintaining procedural quality and safety. Of note, no major adverse events related to procedural delays or cross-contamination were recorded during the study timeframe.

In sum, our experience illustrates the resilience of IR as a specialty capable of rapidly adjusting to public health emergencies. Despite a dramatic change in procedural mix, high-acuity patient care was maintained through strategic planning, interdepartmental coordination, and rigorous infection control. These outcomes offer valuable insights for developing response frameworks in future pandemics and may serve as a model for integrating IR into emergency preparedness protocols on a broader scale.

Table 1: IR Procedure Volume Comparison (March-August)

Procedure Category	2019 Volume	2020 Volume
Total Procedures	732	487
Elective Procedures	398	127
Emergent Procedures	334	360

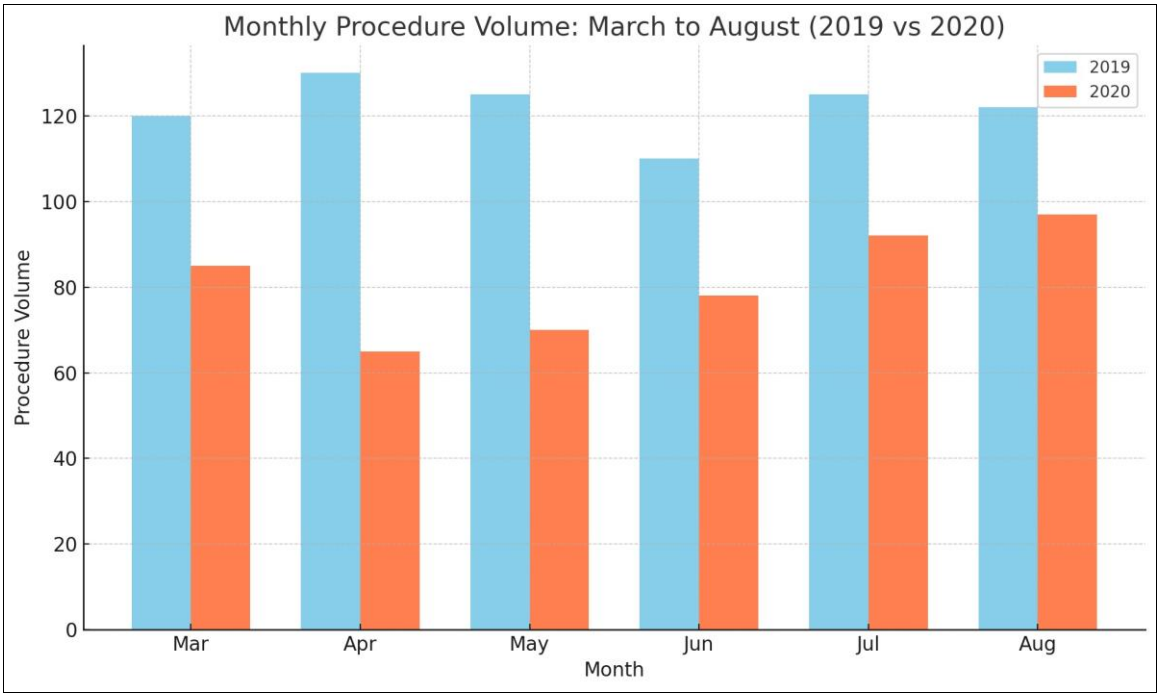

Fig 1: Monthly procedure volume during study period

Conclusion

The COVID-19 pandemic compelled healthcare institutions worldwide to rapidly recalibrate clinical operations, and interventional radiology (IR) departments were no exception. At our tertiary community hospital, IR services demonstrated remarkable agility in navigating the crisis. By swiftly adopting split-team staffing models, implementing stringent infection control protocols, and prioritizing urgent and emergent procedures, the department ensured uninterrupted care delivery for high-acuity patients. Despite a significant reduction in elective case volumes, procedural safety and timeliness were preserved, and no intra-departmental transmission of SARS-CoV-2 was documented. These outcomes underscore the critical role of structured preparedness and interdepartmental collaboration in sustaining essential IR functions during healthcare disruptions.

The experience further highlights the broader value of IR in public health emergencies, not only in procedural delivery but also in its integration with critical care and infectious disease management. The adaptations instituted during the early months of the pandemic—ranging from workflow innovations to enhanced communication strategies—offer a scalable framework for future crisis response. However, to ensure continued advancement and resilience, there is a pressing need for prospective studies that evaluate the long-term clinical, operational, and financial outcomes of these interventions. Such evidence will be vital in informing institutional policies and shaping a robust infrastructure for IR preparedness in future pandemics or system-wide healthcare shocks.

Conflict of Interest

Not available

Financial Support
Not available

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How to Cite This Article
Prasad VN. Adaptation of interventional radiology services amid the covid-19 pandemic: A tertiary care community hospital's early experience. International Journal of Radiology and Diagnostic Imaging. 2025;8(2):41-44.