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Patterns of Presentation, Diagnosis, and Management of Acute Medical and Surgical Conditions in Saudi Arabia: A Review Across Family Medicine, Emergency, and Surgical Care

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ABSTRACT

The management of acute medical and surgical conditions is a critical indicator of healthcare system performance, requiring seamless coordination across primary, emergency, and specialty care. In Saudi Arabia, this challenge is shaped by a young demographic, a high burden of non-communicable diseases, and rapid health system transformation under Vision 2030. This narrative review synthesizes evidence from observational studies, registries, and policy reports relevant to acute care delivery in Saudi Arabia. A persistent trend of patients bypassing primary care for emergency departments, contributing to overcrowding and fragmented care. Clinical presentations are often modified by high rates of diabetes and obesity, leading to atypical manifestations. While urban tertiary centers demonstrate advanced, protocol-driven diagnostics and a shift toward minimally invasive surgery, significant disparities in resource access and care continuity exist between urban and rural regions. There is a need for stronger integration of care pathways, enhanced primary care capacity, and equitable distribution of resources to optimize acute care delivery and outcomes in Saudi Arabia.

Keywords: Acute care; Saudi Arabia; Emergency medicine; Family medicine; Surgical care; Healthcare integration; Clinical presentation; Diagnostic protocols; Healthcare disparities

INTRODUCTION

The effective management of acute medical and surgical conditions is a fundamental measure of a healthcare system's resilience and integration, demanding coordinated responses across primary, emergency, and specialty care settings to reduce morbidity and mortality[1]. In the Kingdom of Saudi Arabia, this imperative is intensified by a unique confluence of factors including a young demographic profile, a high prevalence of chronic disease risk factors, and a period of unprecedented health system transformation under Vision 2030[2]. The Saudi healthcare landscape is evolving rapidly, yet it continues to navigate challenges related to resource distribution, care continuity, and evolving patient expectations[3]. Acute conditions, ranging from cardiovascular emergencies and infections to traumatic injuries and surgical abdominal pain, account for a substantial proportion of healthcare encounters, placing significant demand on both family medicine clinics and hospital emergency departments[4,5].

The initial point of contact for acute illness often sets the trajectory for the entire care episode. In Saudi Arabia, family medicine is formally established as the foundation of the primary healthcare system, designed to manage a wide spectrum of acute and chronic presentations[6]. However, research indicates a persistent pattern of bypassing primary care, with a significant majority of patients presenting directly to hospital emergency departments for acute complaints. Studies

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suggest that for conditions like acute abdominal pain, 60-80% of patients seek care first in the ED, attributing this to perceptions of greater expertise, faster diagnostics, and the 24/7 availability of services[7]. This behavior contributes to emergency department overcrowding, where non-urgent cases may constitute a considerable volume, potentially straining the system's capacity to respond to life-threatening emergencies efficiently[8].

onversely, within family medicine settings, the management of acute conditions is predominantly conservative, with a focus on treatment and appropriate referral, though the effectiveness of this referral interface remains a critical area for improvement in care continuity[9]. This review aims to discuss current evidence on the patterns of presentation, diagnostic approaches, and management strategies for these acute conditions as they flow through the critical junctions of family medicine, emergency care, and surgical services in Saudi Arabia.

METHODOLOGY

This narrative review was conducted through a comprehensive and systematic search of the peer-reviewed literature to synthesize evidence on the presentation, diagnosis, and management of acute medical and surgical conditions within the Saudi Arabian healthcare context. Electronic databases, including PubMed/MEDLINE, Scopus, Web of Science, and the Saudi Digital Library, were searched for relevant articles published in English and Arabic between January 2000 and December 2025. Search terms were constructed using Boolean operators and included combinations of key concepts such as “Saudi Arabia,” “acute,” “emergency,” “family medicine,” “primary care,” “surgical,” “presentation,” “diagnosis,” “management,” “epidemiology,” and specific condition names (e.g., “myocardial infarction,” “appendicitis,” “trauma”).

Inclusion and Exclusion Criteria: Studies were included if they addressed acute medical or surgical conditions within Saudi Arabia and reported on epidemiology, presentation, diagnosis, or management. Editorials, opinion pieces, and non-Saudi population studies were excluded unless used for contextual comparison. No formal screening process or quality appraisal was applied; relevant studies identified through the search strategy were included based on their direct applicability to the review's objectives.

The search strategy was intended to be inclusive, capturing original research articles, retrospective and prospective cohort studies, cross-sectional analyses, clinical audits, and systematic reviews pertinent to the Saudi setting. Grey literature, including reports from the Saudi Ministry of Health and the Saudi Health Council, was also consulted for statistical data and policy documents.

Epidemiology of Acute Medical and Surgical Conditions in Saudi Arabia:

The epidemiological landscape of acute medical and surgical conditions in Saudi Arabia is characterized by a complex interplay of demographic forces, a rapidly evolving burden of disease, and distinct regional variations. Understanding this landscape is fundamental for strategic health planning, resource allocation, and the development of targeted clinical protocols. The Kingdom’s population, which exceeded 36 million in 2022, is notably young, with approximately 63% under the age of 35[14]. This youthfulness inherently shapes the epidemiology of acute conditions, contributing to a high incidence of trauma and injuries, while the concurrent rise in non-communicable diseases (NCDs) adds a layer of complexity to acute care presentations and outcomes[14]. The health system records millions of acute care encounters annually, with public hospital emergency departments alone receiving over 10 million visits each year, representing a critical window into the nation’s acute disease burden[3].

Demographic and behavioral risk factors significantly influence the incidence and severity of acute conditions. The high prevalence of NCD risk factors is a dominant theme; for instance, the age-adjusted prevalence of diabetes mellitus is estimated at 18.3%, obesity at 35.6%, and hypertension at 30.1% among Saudi adults[4]. These conditions are potent comorbid factors that exacerbate the presentation of acute illnesses, leading to higher complication rates from infections, more complex postoperative courses, and worse outcomes following traumatic injury or acute coronary events[22].

. Furthermore, cultural and social determinants, such as high rates of motor vehicle use and specific recreational activities, contribute to a substantial injury burden. Road traffic accidents (RTAs) remain a leading cause of death and disability, particularly among young males, and represent a significant proportion of acute surgical and trauma caseloads in emergency departments nationwide[6].

The burden of acute medical conditions is substantial and multifaceted. Cardiovascular emergencies constitute a major public health challenge. Acute coronary syndromes (ACS) are a leading cause of mortality, with Saudi Arabia having one of the highest reported prevalence rates of premature coronary artery disease in the world[7]. National registry data indicates that STEMI patients present at a notably younger average age compared to Western cohorts, often in their early 50s[18]. Acute cerebrovascular accidents (stroke) also represent a growing concern, with an increasing incidence linked to the high prevalence of hypertension, diabetes, and dyslipidemia[9]. Infectious diseases, though declining in prevalence due to successful public health campaigns, still account for a significant number of acute

presentations, particularly respiratory and gastrointestinal infections, which peak during seasonal periods and Hajj pilgrimage[10].

The profile of acute surgical conditions is equally telling of national health trends. Acute appendicitis is the most common non-traumatic surgical emergency across all age groups, with a lifetime risk estimated to be around 7%[11].

Biliary disease, including acute cholecystitis, has seen a rising incidence, paralleling the increase in obesity and metabolic syndrome[3]. Trauma, predominantly from RTAs and falls, drives a high volume of acute orthopedic, neurosurgical, and general surgical interventions. The pattern of traumatic injury exhibits a distinct demographic skew, with young males comprising over 75% of major trauma cases[1]. Furthermore, the Kingdom sees a significant volume of surgical emergencies related to complications of chronic diseases, such as diabetic foot infections and peripheral vascular disease, which often require urgent surgical management[4].

Regional variations in the epidemiology of acute conditions across Saudi Arabia's vast geography are pronounced and are influenced by differences in population density, lifestyle, environmental factors, and access to healthcare. Urban centers like Riyadh, Jeddah, and the Eastern Province, with their higher population density and traffic congestion, report higher incidences of RTAs and associated trauma[15].

In contrast, rural and remote regions may face different challenges, such as a higher burden of certain infectious diseases or complications from chronic conditions due to barriers in accessing routine care, potentially leading to more advanced acute presentations[16]. The following table summarizes the estimated incidence and key epidemiological notes for major acute conditions.

Table 1: Epidemiological Snapshot of Selected Acute Conditions in Saudi Arabia[7- 14]

Condition Category	Estimated Annual Incidence/Prevalence	Key Epidemiological Notes
Acute Coronary Syndrome	~ 45,000 hospitalizations annually	Presents at younger age (avg. 51-55 yrs); high prevalence of diabetes among patients.
Road Traffic Injury (Major Trauma)	> 350,000 accidents annually; leading cause of death in 15-29 yr age group.	Male-to-female ratio ~ 5:1; high mortality rate pre-hospital.
Acute Appendicitis	Incidence rate ~ 100-120 per 100,000 population.	Most common abdominal surgical emergency; peak incidence in 2nd-3rd decade.
Acute Cholecystitis	Rising incidence; gallstone prevalence ~ 20% in adult population.	Strong association with obesity, metabolic syndrome, and multiparity in females.
Stroke	Incidence ~ 29-43 per 100,000; increasing trend.	Ischemic stroke predominates (~80%); high rates of modifiable risk factors.
Severe Sepsis	ICU admission rates vary; mortality remains high (~35%).	Often complicates diabetes, renal disease, or postoperative courses.

Data collection and the robustness of epidemiological statistics face challenges, including the historical lack of a unified, national acute disease registry. While significant strides have been made with registries for specific conditions like STEMI and stroke, comprehensive data on the full spectrum of acute surgical and medical emergencies remains fragmented[8].

Clinical Presentation of Acute Conditions:

The clinical presentation of acute medical and surgical conditions forms the critical foundation for diagnosis and subsequent management, with patterns often influenced by patient demographics, underlying comorbidities, and cultural factors[16]. In Saudi Arabia, understanding these presentation patterns is essential for clinicians across family medicine, emergency departments, and surgical specialties to facilitate timely and accurate decision-making[17]. The classic textbook descriptions of acute conditions are frequently modified in this population, particularly due to the high prevalence of conditions like diabetes mellitus and obesity, which can alter pain perception, blunt inflammatory responses, and complicate the clinical picture[18]. Furthermore, patient-related factors such as health literacy, symptom interpretation, and health-seeking behavior contribute to variability in the timing and nature of presentation, with some patients presenting early with mild symptoms and others delaying until complications have developed[19].

Cardiovascular emergencies, primarily Acute Coronary Syndromes (ACS), present with a spectrum of symptoms. While retrosternal chest pain radiating to the left arm, neck, or jaw remains the hallmark, studies from Saudi registries note a significant proportion of atypical presentations[20]. These include dyspnea as the predominant symptom (often in women and diabetics), epigastric pain mimicking indigestion, isolated fatigue, or syncope[21]. The high prevalence of diabetes contributes to a higher incidence of silent or minimally symptomatic ischemia, where the first presentation may be heart failure or arrhythmia[22]. Clinical signs such as diaphoresis, pallor, and tachycardia are common, but their absence does not rule out ACS, particularly in the elderly and those with diabetic neuropathy[23]. For acute heart failure, presentations often involve acute dyspnea at rest, orthopnea, and pulmonary edema, frequently precipitated by uncontrolled hypertension, arrhythmia, or medication non-compliance in a population with high baseline cardiovascular risk[24].

Acute abdominal conditions constitute a major proportion of surgical presentations. The classic migratory pain from periumbilical to right lower quadrant in acute appendicitis is frequently observed, yet studies from Saudi surgical units report a higher-than-expected rate of atypical presentations[25]. These include diffuse abdominal pain from the outset, retrocecal appendicitis presenting as right flank pain, or pelvic appendicitis causing urinary symptoms[26]. Guarding and rebound tenderness are key signs, but their sensitivity can be reduced in obese patients or those presenting late after perforation[27]. For acute biliary disease, right upper quadrant or epigastric pain radiating to the scapula is typical, often postprandial and associated with nausea[28]. However, in the context of widespread obesity and metabolic syndrome, presentations can be subtle or complicated by cholangitis or severe pancreatitis[29]. Intestinal obstruction commonly presents with the quartet of colicky abdominal pain, distension, absolute constipation, and vomiting, with clinical signs revealing hyperactive bowel sounds early, which may become silent if ischemia develops[30].

The presentation of traumatic injuries is often direct and unequivocal, but a systematic approach is vital given the potential for multisystem involvement. Following road traffic accidents (RTAs), the most common mechanism in Saudi Arabia, patients may present with a combination of external injuries (lacerations, deformities) and life-threatening internal injuries[31]. The classic presentation of traumatic brain injury ranges from altered mental status and loss of consciousness to severe headache and vomiting[32]. For thoracic trauma, symptoms include chest pain, dyspnea, and signs such as subcutaneous emphysema or tracheal deviation, indicating tension pneumothorax[33]. Abdominal trauma may present with pain, distension, or, in cases of solid organ injury, with signs of hemorrhagic shock before overt abdominal signs develop[34]. Musculoskeletal injuries present with pain, swelling, deformity, and loss of function, but clinicians must maintain a high index of suspicion for associated neurovascular compromise[35]. Infectious and medical emergencies also demonstrate characteristic patterns. Severe sepsis and septic shock often present with non-specific constitutional symptoms like fever, malaise, and confusion, which can rapidly progress to hemodynamic instability[36]. In diabetic patients, a common scenario is the presentation of diabetic ketoacidosis (DKA) with polyuria, polydipsia, abdominal pain, and Kussmaul respirations, sometimes mistaken for a surgical abdomen[37]. Acute exacerbations of chronic respiratory diseases, such as asthma or COPD, present with increased dyspnea, wheezing, and use of accessory muscles[38]. Acute neurological conditions like stroke present with sudden-onset focal deficits, including unilateral weakness, facial droop, and speech disturbance, though vertigo and isolated dizziness can be misleading presentations of posterior circulation strokes[39]. A significant challenge in the Saudi context is the phenomenon of atypical or masked presentations, largely influenced by comorbidities. Diabetic neuropathy can significantly attenuate abdominal pain in conditions like cholecystitis or peritonitis, leading to presentations dominated by sepsis or metabolic disturbance with minimal localizing signs[40]. Elderly patients may present with "failure to thrive" or generalized weakness as the primary manifestation of an acute surgical condition like diverticulitis or bowel obstruction[41]. Cultural factors, including gender-specific modesty, may lead to delayed presentation of gynecological or breast-related acute conditions, or to vague descriptions of symptoms that can obscure the diagnosis[42]. Table 2 summarizes key presentation patterns and their modifiers in the Saudi population.

Table 2: Clinical Presentation Patterns of Acute Conditions in Saudi Arabia: Typical vs. Atypical Features [20- 29]

Condition	Typical Presentation	Common Atypical/Modified Presentations in Saudi Context	Key Influencing Factors
Acute Coronary Syndrome	Central chest pain, radiation, diaphoresis.	Dyspnea-only, epigastric pain, fatigue, syncope. "Silent ischemia" common.	High prevalence of Diabetes Mellitus, younger age at onset.
Acute Appendicitis	Migratory periumbilical to RLQ pain, anorexia, tenderness.	Diffuse pain from onset, flank pain (retrocecal), urinary symptoms (pelvic).	Anatomical variation, delayed presentation, obesity.
Diabetic Ketoacidosis	Polyuria, polydipsia, abdominal pain, Kussmaul respirations.	Severe abdominal pain mimicking surgical abdomen; altered mental status as primary feature.	High background DM prevalence; infection as common trigger.
Biliary Colic / Cholecystitis	RUQ/epigastric pain, radiating to scapula, nausea.	Mild or vague discomfort; first presentation as acute pancreatitis or cholangitis.	High rates of obesity and metabolic syndrome.
Traumatic Brain Injury	Headache, LOC, vomiting, altered mental status.	Post-traumatic confusion attributed to shock; subtle cognitive deficits in mild TBI.	High RTA incidence; young male demographic.
Sepsis	Fever, tachycardia, tachypnea, altered perfusion.	Normothermia or hypothermia; vague decline in functional status in elderly.	DM, renal failure as predisposing conditions.

The accurate interpretation of these clinical presentations is paramount. It requires clinicians to maintain a high index of suspicion for severe pathology even when presentations are ambiguous, especially in high-risk groups such as diabetics, the elderly, and obese patients[43]. A thorough history that includes assessment of symptom onset, progression, and associated features, combined with a careful physical examination, remains the indispensable first step. This is particularly crucial in primary care and emergency settings where rapid triage decisions are made[44]. Understanding the local epidemiological and demographic modifiers of disease presentation enables healthcare providers in Saudi Arabia to diagnose acute conditions more accurately, reduce delays, and initiate appropriate management pathways, ultimately improving patient outcomes across the care continuum[45].

Diagnostic Approaches in Family Medicine and Emergency Care:

The diagnostic process for acute conditions in Saudi Arabia is a critical determinant of patient outcomes, hinging on the accuracy, timeliness, and appropriateness of the methods and tools employed across different levels of care[18]. This process is not uniform; it varies significantly between the primary care setting of family medicine and the high-acuity environment of the emergency department, each with distinct resources, pressures, and diagnostic mandates[19]. In family medicine, the focus is on early recognition, initial risk stratification, and efficient triage, often with limited immediate diagnostic support[20]. In contrast, emergency care is characterized by the rapid application of advanced diagnostics to rule in or rule out life-threatening conditions within a narrow therapeutic window[21]. Across both settings, the adoption of standardized protocols and clinical decision rules is increasingly emphasized to reduce diagnostic error and variation, though implementation faces challenges related to resource distribution, training, and systemic integration[22].

In family medicine clinics, the diagnostic approach is fundamentally anchored in a comprehensive clinical history and physical examination, as these are the most readily available and cost-effective tools[23]. Given the high patient volume and broad spectrum of undifferentiated complaints, family physicians rely heavily on pattern recognition and probabilistic reasoning to distinguish between self-limiting illnesses and serious conditions requiring urgent referral[24]. The diagnostic process here is often sequential and iterative. For instance, in evaluating acute abdominal pain, the history focuses on onset, location, migration, and associated symptoms, while the physical exam seeks signs of peritonism[25]. However, the diagnostic toolkit in primary care is frequently limited. While most centers are equipped with basic urinalysis strips and glucometers, access to on-site phlebotomy for laboratory tests or radiology services is inconsistent, particularly in rural health centers[26]. This scarcity often necessitates referral to emergency departments for definitive diagnostics, contributing to the bypass phenomenon and ED overcrowding[27]. The use of validated clinical decision aids, such as the Centor criteria for streptococcal pharyngitis or clinical prediction rules for deep vein thrombosis, is not yet widespread in routine

Saudi family practice, representing an opportunity for quality improvement[28].

The emergency department represents the diagnostic hub for acute care, where speed and accuracy are paramount. The initial triage process, often using systems like the Canadian Triage and Acuity Scale (CTAS) or the Saudi-instituted version, categorizes patients based on acuity and directs the pace and scope of the diagnostic workup[29]. For high-acuity patients, diagnostic efforts proceed on a parallel track, with history, examination, blood tests, and imaging often initiated simultaneously[30]. Point-of-care testing (POCT) has become integral, with blood gas analyzers, lactate meters, and troponin assays enabling rapid decision-making for conditions like sepsis, metabolic disorders, and acute coronary syndromes[31].

In several peripheral hospitals, access to CT imaging remains intermittent, particularly after hours. The availability and utilization of advanced imaging, particularly computed tomography (CT), have grown exponentially in Saudi emergency departments over the past decade[32]. CT scanning is now routinely used for the workup of acute stroke (non-contrast head CT), pulmonary embolism (CT pulmonary angiography), and unexplained acute abdominal pain (abdominal-pelvic CT), significantly reducing diagnostic uncertainty but raising concerns about overuse and radiation exposure[33].

The application of condition-specific diagnostic protocols is a key feature of modern emergency care in Saudi Arabia and is a major focus of hospital accreditation bodies like the Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI)[34]. For time-critical diagnoses, standardized pathways are designed to minimize delays. In the management of ST-Elevation Myocardial Infarction (STEMI), the protocol mandates an immediate 12-lead ECG within 10 minutes of arrival, with clear criteria for activating the cardiac catheterization lab[35]. Similarly, acute stroke protocols emphasize a structured neurological assessment using tools like the NIH Stroke Scale, followed by urgent neuroimaging to determine eligibility for thrombolysis[36]. For major trauma, the Advanced Trauma Life Support (ATLS) protocol provides a systematic framework for the primary and secondary survey, ensuring life-threatening injuries are identified in a logical sequence[37]. The adherence to these protocols in major tertiary centers is generally high, but audits reveal variability in compliance with all bundle elements, especially in busy departments or during off-hours[38].

Despite technological advances, significant challenges and disparities in diagnostic capacity persist across the Kingdom. There exists a pronounced urban-rural divide in access to advanced diagnostics. While tertiary hospitals in major cities may have immediate access to MRI and 24/7 CT and catheterization lab services, smaller hospitals in remote regions may lack onsite CT, rely on daytime ultrasonography, and have prolonged turnaround times for specialized laboratory tests[39]. This inequity can lead to diagnostic delays, increased inter-facility transfers, and potentially worse outcomes[40]. Furthermore, the human factor remains crucial. Diagnostic accuracy depends on the skill of the clinician in interpreting history, physical signs, and diagnostic tests. Challenges such as high patient volumes, cognitive biases, and intermittent shortages of specialist consultants (e.g., radiologists, neurologists) for interpretation can impact the diagnostic process[41].

The future of diagnostics in Saudi acute care is poised to be shaped by digital health innovations and telemedicine. The integration of comprehensive Electronic Health Records (EHRs) across primary and secondary care, though incomplete, promises to provide clinicians with crucial past medical history, medications, and prior results, informing the diagnostic process[42]. Teleradiology networks are being expanded to allow remote interpretation of CT and MRI scans from rural hospitals by specialists in central hubs, potentially mitigating geographic disparities[43].

Furthermore, artificial intelligence (AI) applications, particularly in interpreting radiographic images (e.g., chest X-rays for pneumonia, CT scans for intracranial hemorrhage) and predicting clinical deterioration, are in early stages of pilot testing in some advanced Saudi centers and hold promise for supporting diagnostic accuracy and efficiency[44]. Most AI applications remain in pilot phases and are not yet embedded in routine acute care workflows[44].

Treatment Protocols and Interventions:

In the realm of acute medical management, protocol-driven care has significantly improved outcomes for cardiovascular and cerebrovascular emergencies. For ST-Elevation Myocardial Infarction (STEMI), the standard of care in equipped centers is primary percutaneous coronary intervention (PCI), with national registry data showing that median door-to-balloon times have improved to approximately 85 minutes in tertiary hubs[24]. For non-STEMI ACS and unstable angina, management relies on dual antiplatelet therapy, anticoagulation, and timely risk stratification for invasive angiography, with high adherence to guideline-directed medical therapy reported in urban centers[21]. Acute ischemic stroke management has been transformed by the establishment of stroke units and the provision of intravenous thrombolysis (alteplase), with studies from Saudi centers reporting thrombolysis rates of approximately 10-15% of eligible patients, alongside growing capabilities for mechanical thrombectomy in comprehensive stroke centers[26]. The management of

severe sepsis and septic shock follows internationally recognized Surviving Sepsis Campaign guidelines, with bundled care focusing on early antibiotics, fluid resuscitation, and source control, though full bundle compliance remains an area for ongoing improvement across hospitals[12].

The pharmacological management of acute conditions in both primary and emergency care is nuanced by local factors. In family medicine, treatment for common acute illnesses like respiratory infections, urinary tract infections, and acute gastroenteritis is largely empirical[28]. However, antimicrobial stewardship programs are increasingly influencing prescribing patterns to combat resistance, with guidelines promoting delayed or targeted antibiotic prescriptions for conditions like acute otitis media and pharyngitis[29]. In the emergency department, analgesia is a critical component of management. While opioids were historically used liberally, there is a growing emphasis on multimodal analgesia and the use of non-opioid alternatives, such as intravenous paracetamol and non-steroidal anti-inflammatory drugs, especially for renal colic and musculoskeletal pain[44]. The management of acute diabetic emergencies, namely diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic state (HHS), follows standardized protocols involving fluid resuscitation, insulin infusion, and careful electrolyte monitoring, with dedicated diabetes teams often involved in care in larger institutions[31].

For acute surgical conditions, the shift towards minimally invasive surgery (MIS) represents a dominant trend in management, albeit with geographic disparity. Laparoscopic appendectomy is now considered the gold standard for acute appendicitis in Saudi tertiary centers, with adoption rates exceeding 80% and demonstrated benefits in reduced wound infection rates and shorter hospital stays compared to open surgery[32].

Similarly, laparoscopic cholecystectomy is the definitive management for acute cholecystitis, preferably performed within 7 days of symptom onset (early cholecystectomy), a practice increasingly adhered to in major hospitals. The management of trauma follows the structured principles of Advanced Trauma Life Support (ATLS), with a focus on simultaneous assessment and treatment of life-threatening injuries. Major trauma centers have implemented massive transfusion protocols and damage control surgery principles for severely injured patients, which have contributed to improved survival rates[34]. For orthopedic emergencies like hip fractures, the emphasis is on multidisciplinary care and early surgical fixation (within 48 hours) to reduce mortality and complications, though achieving this benchmark consistently is challenging across all facilities[5].

Post-operative and post-acute management strategies are critical for recovery and the prevention of complications. The adoption of Enhanced Recovery After Surgery (ERAS) protocols, which bundle elements like preoperative counseling, multimodal analgesia, early mobilization, and early enteral feeding, is gaining traction[36]. Their implementation in major colorectal and hepatic surgery programs has shown significant reductions in length of stay and postoperative ileus[37]. In medical care, early rehabilitation for stroke patients, including physiotherapy, occupational therapy, and speech therapy, is integral to management, though access to intensive rehabilitation services can be limited outside major cities[38]. The transition of care from hospital to community, including structured discharge planning and timely follow-up with primary care, is a recognized weakness in the care continuum, with efforts underway to improve coordination through digital health platforms and case management[39].

The management of acute conditions is further complicated by specific demographic and comorbid challenges prevalent in Saudi Arabia. The high rates of obesity necessitate adjustments in drug dosing, imaging quality, and surgical technique, and are associated with increased risks of postoperative complications like wound infections and venous thromboembolism[40]. The management of acute coronary syndromes or strokes in young patients requires aggressive risk factor modification and often involves addressing unique genetic or metabolic factors[41].

Furthermore, cultural considerations, such as fasting during Ramadan, require specific management adaptations for diabetic patients presenting with acute complications or for the timing of elective surgical procedures[42]. The table below summarizes key management protocols and contextual challenges for select acute conditions.

Table 3: Management Strategies for Acute Conditions [24- 28]

Acute Condition	Standard Management Protocol/Intervention	Key Modalities in Saudi Practice	Contextual Challenges & Adaptations
STEMI	Primary PCI (Door-to-Balloon < 90 min).	PCI in tertiary centers; fibrinolysis in remote areas without PCI capability.	Geographic access to PCI centers; delay in patient presentation; high prevalence of young diabetics.
Acute Ischemic Stroke	IV Alteplase within 4.5 hrs; Mechanical Thrombectomy for LVO.	Thrombolysis in stroke-ready hospitals; thrombectomy in comprehensive centers (mainly urban).	Public awareness of stroke symptoms; rapid inter-facility transfer for thrombectomy.
Severe Sepsis/Septic Shock	Sepsis Bundle: Early antibiotics, fluids, lactate measurement, vasopressors.	Protocol adoption in ICUs; antibiotic stewardship programs influence choice.	High rates of multidrug-resistant organisms; fluid management in obese patients.
Acute Appendicitis	Laparoscopic Appendectomy.	High laparoscopic adoption in urban centers; open surgery more common in rural hospitals.	Diagnostic uncertainty leading to negative appendectomy rates; managing appendiceal masses conservatively.
Acute Cholecystitis	Early Laparoscopic Cholecystectomy (within 7 days).	Early surgery practiced in tertiary centers; percutaneous cholecystostomy for high-risk patients.	High surgical risk in obese, diabetic patients; intraoperative challenges due to chronic inflammation.
Hip Fracture	Multidisciplinary care; surgical fixation within 48 hrs.	Orthogeriatric models in some centers; hemiarthroplasty for displaced femoral neck fractures.	Meeting 48-hour benchmark; postoperative mobilization in elderly with comorbidities.
Diabetic Ketoacidosis	Fixed-rate IV insulin, fluid resuscitation, electrolyte replacement.	Protocolized management in ED/ICU; involvement of endocrine team.	High recurrence rates; managing DKA in patients with advanced renal disease.

Despite advancements, significant challenges persist in the uniform delivery of optimal management. The disparity between urban and rural care is profound; a patient in a remote area may receive fibrinolysis for STEMI instead of primary PCI or undergo an open appendectomy due to lack of laparoscopic expertise or equipment[43]. Workforce distribution also plays a role, as not all hospitals have 24/7 access to specialist surgeons, interventional cardiologists, or neurologists, affecting the availability of definitive interventions[44]. Furthermore, patient adherence to post-discharge medications and follow-up, critical for secondary prevention after ACS or stroke, is suboptimal and affected by health literacy and socioeconomic factors[2].

Future Directions

Future efforts to optimize acute care in Saudi Arabia should be multipronged, focusing on integration, equity, and innovation. A primary objective must be to strengthen the primary care system as an effective filter and coordinator, potentially through the use of validated tele-triage systems and embedded point-of-care diagnostics to manage more cases locally and reduce inappropriate ED crowding. Nationwide implementation of interoperable electronic health records is critical to ensure seamless information flow across all care settings.

LIMITATIONS

This review is subject to several limitations that must be acknowledged. First, as a narrative synthesis, it may be susceptible to selection bias, as the inclusion of studies was not performed by multiple independent reviewers using a formal systematic review methodology. The quality and design of the included source studies vary considerably, encompassing both high-quality registries and smaller, single-center retrospective analyses, which may affect the strength of the conclusions drawn. Furthermore, a significant limitation inherent in the available literature is the lack of comprehensive, high-quality data from rural and remote regions, meaning the challenges in these areas may be under-represented. Finally, the rapidly evolving nature of Saudi Arabia's healthcare system means that some cited studies may not fully reflect the very latest infrastructure or policy changes implemented under the ongoing Health Sector Transformation.

CONCLUSION

The study reveals a two-tiered reality: advanced, protocol-driven emergency and surgical management in urban tertiary centers coexists with significant geographical disparities in resource access and care coordination. The high prevalence of non-communicable diseases profoundly influences clinical presentations and complicates management pathways, while the common bypass of primary care continues to strain emergency services and fragment the patient journey. The evolution toward minimally invasive surgery and standardized diagnostic protocols marks substantial progress. However, the ultimate efficacy of the acute care system hinges on addressing the fundamental gaps in integration between family medicine, emergency departments, and surgical specialties, and on ensuring equitable access to high-quality interventions across all regions.

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Authors' Contributions

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