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ECG and Rapid Cardiological Assessment in Ambulatory Care and the Emergency Department (A&E)

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Abstract

Background

The 12-lead electrocardiogram (ECG) is a cornerstone of rapid cardiological assessment, enabling timely detection of life-threatening conditions such as ST-elevation myocardial infarction (STEMI), arrhythmias, and acute coronary syndromes. In the Emergency Department (A&E/ED), guidelines recommend ECG acquisition and interpretation within 10 minutes of arrival for patients with suspected acute coronary syndrome to optimize outcomes. In ambulatory care settings, ECG use supports selective evaluation of symptomatic patients and risk stratification. This review examines the clinical applications, challenges, and the pivotal role of A&E Consultants in ensuring high-quality, efficient cardiological assessment across both environments.

Methods

A narrative synthesis was conducted based on peer-reviewed literature from PubMed, focusing on door-to-ECG (DTE) times, ECG interpretation accuracy by emergency physicians, integration with clinical risk scores (e.g., HEART score), quality improvement initiatives, and the contribution of senior emergency medicine consultants to real-time decision-making and departmental oversight.

Key-Findings

Delays in door-to-ECG time are associated with increased morbidity and mortality in STEMI patients. Quality improvement interventions—including triage nurse-led ECG acquisition, dedicated ECG stations, staff education, and process standardization—have successfully reduced median DTE times and improved compliance with the 10-minute target. Emergency physicians, including senior

residents and consultants, demonstrate moderate accuracy in ECG interpretation, with discordance rates versus cardiologists ranging from 30–58% for abnormal tracings, particularly in subtle ischaemic changes, anterior wall infarction, and arrhythmias. While experienced A&E Consultants achieve higher proficiency and provide critical oversight for ambiguous or high-risk cases, real-time cardiology review or structured quality assurance processes can further enhance diagnostic precision and patient safety. In ambulatory care, targeted ECG and ambulatory monitoring effectively identify intermittent arrhythmias while avoiding unnecessary referrals. Integrated pathways bridging A&E and ambulatory services, supported by Consultant-level coordination, facilitate safe discharge of low-to-intermediate risk patients using multimodal tools (ECG + HEART score + high-sensitivity troponin).

Conclusion

Rapid ECG-based cardiological assessment remains essential in both ambulatory and emergency settings. At the Consultant A&E level, senior emergency physicians serve as key decision-makers, educators, and quality leaders, balancing speed with accuracy under time pressure. Ongoing emphasis on protocol standardization, targeted training, collaborative review processes, and judicious integration of emerging technologies (e.g., AI-assisted interpretation) is required to optimize performance, reduce errors, and improve patient outcomes in an increasingly demanding healthcare environment.

Keywords: Electrocardiogram (ECG), door-to-ECG time, emergency department, A&E Consultant, rapid cardiological assessment, HEART score, STEMI triage, ECG interpretation accuracy

Introduction

The electrocardiogram (ECG) remains one of the most fundamental, rapid, and cost-effective diagnostic tools in cardiological assessment. In both ambulatory care and the Emergency Department (A&E/ED), timely ECG acquisition and accurate interpretation are essential for risk stratification, early diagnosis of life-threatening conditions, and guiding management. This article examines clinical applications, challenges, and best practices, with particular emphasis on the critical role of **A&E Consultants** (Emergency Medicine Consultants) at the senior decision-making level.

The Role of ECG in the Emergency Department (A&E)

In the A&E, patients frequently present with acute symptoms such as chest pain, dyspnoea, palpitations, syncope, or pre-syncope. The ECG functions as a critical "vital sign" that must be obtained and interpreted rapidly. Major guidelines recommend performing a 12-lead ECG within **10 minutes** of arrival for patients with suspected acute coronary syndrome (ACS). Delays in door-to-ECG (DTE) time correlate with worse outcomes, particularly in ST-elevation myocardial infarction (STEMI).

Key applications in the ED include rapid detection of STEMI or ischaemic changes, risk stratification (e.g., using the HEART score), identification of arrhythmias or conduction abnormalities, and efficient triage. Quality improvement initiatives focusing on triage protocols, dedicated ECG resources, and staff education have successfully reduced DTE times in busy departments.

Senior Oversight, Decision-Making, and Quality Assurance

ECG interpretation moves beyond initial screening to high-stakes clinical integration, final decision-making, and system-level oversight. Emergency Medicine Consultants bear ultimate responsibility for patient safety in a high-volume, high-acuity environment where rapid yet accurate decisions directly affect reperfusion strategies, admission/discharge choices, and resource allocation.

Accuracy and Limitations of Interpretation

Studies consistently show moderate concordance between emergency physicians (including senior residents and consultants) and cardiologists when interpreting ED ECGs. Discordance rates for abnormal ECGs can reach 50–58%, with clinically significant misses often involving ischaemia/infarction (especially anterior wall), atrial fibrillation, or subtle ST/T-wave changes. While experienced Consultants generally outperform junior doctors, accuracy remains imperfect, particularly under time pressure. Senior emergency physicians achieve higher proficiency than trainees, but real-time or next-day cardiology review can still identify important discrepancies that alter management in a subset of cases.

Role in Real-Time Decision-Making

A&E Consultants frequently serve as the final gatekeeper for:

- Activating the cardiac catheterisation laboratory for suspected STEMI (or equivalents such as posterior or hyperacute T-wave patterns).

- Interpreting ambiguous or high-risk ECGs in the context of full clinical picture, high-sensitivity troponin, and point-of-care ultrasound.

- Over-ruling or confirming initial interpretations by middle-grade doctors or advanced nurse practitioners.

- Deciding on safe discharge versus observation/admission for intermediate-risk chest pain using integrated scores (HEART, EDACS) plus ECG findings.

In many departments, senior EM residents or Consultants act as primary interpreters for all ED ECGs, escalating only concerning abnormalities to the attending Consultant or cardiology. Formal Consultant review is especially valuable in complex cases (e.g., bundle branch block with suspected occlusion, paced rhythms, or toxin-related changes).

Quality Assurance and Educational Leadership

Consultants play a pivotal role in departmental quality improvement:

- Daily or next-day review of abnormal ECGs against final cardiology reports.

- Feedback loops to reduce interpretation errors and improve documentation.

- Training and competency assessment of junior doctors and nurses in systematic ECG reading.

- Development of local protocols for rapid ECG acquisition and interpretation.

Evidence indicates that structured Consultant-led review processes, combined with targeted education, can significantly shorten interpretation times and improve overall ECG utilisation.

Challenges

Even experienced Consultants face challenges including cognitive overload during peak hours, atypical presentations, and the need to balance speed with diagnostic certainty. Emerging tools such as AI-assisted ECG interpretation are

increasingly used as a "second pair of eyes," but Consultant oversight remains essential to integrate AI outputs with clinical context and mitigate algorithmic bias.

ECG in Ambulatory Care Settings

In ambulatory/outpatient or primary care settings, ECG use is typically more selective and symptom-driven. Indications include evaluation of palpitations, atypical chest pain, syncope, or risk assessment in patients with comorbidities. Ambulatory monitoring (Holter, event recorders, or wearable devices) captures intermittent arrhythmias that a single 12-lead ECG may miss. Routine screening in asymptomatic low-risk patients is generally not recommended.

Bridging Ambulatory Care and A&E: Integrated Pathways

Effective systems link the two settings through rapid-access chest pain clinics, same-day cardiology review, and safe discharge protocols with outpatient follow-up. A&E Consultants often coordinate these pathways, ensuring appropriate patients transition smoothly from acute to ambulatory care.

Best Practices and Future Directions

To optimise ECG and rapid cardiological assessment at all levels, especially Consultant A&E:

1. **Standardise acquisition and initial review** — Achieve DTE <10 minutes through dedicated triage protocols and role delegation.
2. **Ensure Consultant-level oversight** — Mandate timely senior review for high-risk or ambiguous ECGs; maintain robust QA processes involving cardiology collaboration when needed.
3. **Integrate multimodal tools** — Combine ECG with clinical scores, biomarkers, and point-of-care testing.
4. **Invest in education and technology** — Provide ongoing Consultant-led training and judicious use of AI support.
5. **Foster collaboration** — Develop clear escalation pathways between A&E Consultants and cardiology for complex cases.

In summary, while junior and middle-grade staff perform initial ECG acquisition and interpretation, the **A&E Consultant** level provides the critical layer of expertise, accountability, and system leadership that ensures safe, efficient, and high-quality rapid cardiological assessment in the Emergency Department.

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