Towards evidence based emergency medicine: best BETs from the Manchester Royal Infirmary

Edited by K Mackway-Jones

BEST EVIDENCE TOPIC REPORTS

Diagnostic utility of electrocardiogram for diagnosing pulmonary embolism

Report by Ged Brown, Specialist Registrar
Search checked by Kerstin Hogg, Clinical Research Fellow
doi: 10.1136/emj.2005.029041

Abstract
A shortcut review was carried out to establish the diagnostic utility of electrocardiography in patients with suspected pulmonary embolus (PE). Altogether 952 papers were found using the reported search, of which five presented the best evidence to answer the clinical question. The author, date, and country of publication, patient group studied, study type, relevant outcomes, results, and study weaknesses of these best papers are tabulated (table 1). It is concluded that although there are electrocardiogram (ECG) changes that are more common in PE, the ECG alone is not sufficiently sensitive or specific to rule out or in the diagnosis.

Clinical scenario
A 30 year old man presents to the emergency department with a spontaneous onset of atrumatic pleuritic chest pain. He is in a low risk group clinically. The medical registrar suggests that the fact that the ECG is normal makes the diagnosis of PE much less likely. You wonder whether his assertion that a normal ECG will help to exclude a PE is safe.

Three part question
In [a patient presenting with features suggestive of pulmonary embolus] what is [the diagnostic utility of ECG] in [stratifying risk of pulmonary embolus]?

Search strategy

[[Pulmonary embolism MeSH OR thromboembolism MeSH]] AND [[electrocardiography MeSH]].

Search outcome
Altogether 992 papers were found of which 947 were not directly relevant to the question, were of insufficient quality, or did not report enough data to assess the diagnostic utility of ECG or a scoring system in which it was included. The remaining papers are summarised in the table below.

Comments
Although it is clear that there are some ECG changes that occur more frequently in patients with PE, these occur infrequently. There is no evidence that an ECG alone has adequate sensitivity or specificity to rule out or in a PE. It may have utility as part of risk stratification strategies.

CLINICAL BOTTOM LINE
An ECG alone is of little value in the diagnosis of PE. Its main value is in ruling out other causes of the presenting symptoms, or as part of a risk stratification strategy to inform a further investigative protocol.

Table 1

<table>
<thead>
<tr>
<th>Author, date, country</th>
<th>Patient group</th>
<th>Study type</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Study weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rodger M et al, 2000, Canada</td>
<td>212 consecutive patients referred for V/Q or pulmonary angiogram for suspected PE</td>
<td>Prospective validation of previously derived scoring system</td>
<td>Prevalence of 28 ECG abnormalities in those subsequently diagnosed as PE positive (49) or negative (116)</td>
<td>Only 2 abnormalities (tachycardia and incomplete RBBB) significantly more prevalent in PE positive than PE negative patients</td>
<td>Diagnostic utility of ECG scoring system (previously derived in patients diagnosed as PE positive) assessed for validation in PE positive and negative patients respectively</td>
</tr>
<tr>
<td>Miniati M et al, 2000, Italy</td>
<td>168 (derivation) and 139 (validation) inpatients suspected of PE</td>
<td>Prospective derivation/ validation study</td>
<td>Risk factors, objective clinical signs, LDH, ECG (‘signs of right heart strain’), arterial blood gases, venography/plethysmography results and chest x ray recorded</td>
<td>Multivariate logistic regression established those associated with the diagnosis of PE ‘PE score’ (including ECG signs of right heart strain) developed and validated in second group</td>
<td>Individual signs 16–48% sensitive for PE; 83–94% specific</td>
</tr>
<tr>
<td>Stollberger C et al, 2000, Austria</td>
<td>169 (validation) and 133 (derivation) patients referred for investigation for suspected PE</td>
<td>Prospective derivation/ validation study</td>
<td>Scoring system (included ECG signs of right heart strain) developed that divides patients into low, intermediate, moderately high, and high groups</td>
<td>PE score performance is reported for 17 different scores in paper. Examples are given below: PE score &gt;0.3 Sn 100%, Sp 79%</td>
<td>Inpatient population only</td>
</tr>
<tr>
<td>Sinha N et al, 2005, USA</td>
<td>Patients undergoing CT pulmonary angiography at a tertiary hospital over 30 months</td>
<td>Retrospective cohort</td>
<td>ECG changes significantly associated with PE</td>
<td>ECG changes classically associated with PE</td>
<td>No prospective validation study (cross validation only)</td>
</tr>
<tr>
<td>Richman PB et al, 2004, USA</td>
<td>Patients assessed for PE over 1 year. 49 with PE compared with 49 without</td>
<td>Observational</td>
<td>ECG changes classically associated with PE</td>
<td>Sinus tachycardia (18.8% v 11.8%), incomplete RBBB (4.2% v 0%), S1Q3T3 (2.1% v 0%)</td>
<td>Incomplete cohort used in that 252 patients investigated for PE were not used in analysis</td>
</tr>
</tbody>
</table>

ECG, electrocardiogram; LDH, lactate dehydrogenase; PE, pulmonary embolus.

**Differential diagnosis of narrow complex tachycardias by increasing electrocardiograph speed**

**Abstract**

A shortcut review was carried out to establish whether increasing the paper speed during ECG recording could improve the accuracy of diagnosis of narrow complex tachycardias. Altogether 256 papers were found using the reported search, of which one presented the best evidence to answer the clinical question. The author, date, and country of publication, patient group studied, study type, relevant outcomes, results, and study weaknesses of these best papers are tabulated in table 2. It is concluded that increasing paper speed does indeed improve diagnostic accuracy.

**Clinical scenario**

A 60 year old Asian female, who speaks little English, is brought to the emergency department with what seems to be a three day history of worsening exertional dyspnoea and a 3 hour history of resting dyspnoea with light-headedness. On examination she is apyrexial with a pulse of 150 beats/min, a respiratory rate of 20/min, blood pressure 100/60, and oxygen...

---

**References**


---

**www.emjonline.com**
Arrhythmia-atrial#.de. OR Tachycardia-atrial#.de. OR Atrial-fibrillation#.de. OR Atrial-flutter#.de. OR (narrow ADJ complex ADJ tachycardia).mp. OR SVT.mp.] AND [Electrocardiography#.w..de. OR ECG.mp. OR EKG.mp. OR electrocardiogra$.mp.] AND [diagnos$.mp. OR differential$.mp.] AND [speed.mp. OR velocity.mp. OR 25 mm$.mp. OR 50 mm$.mp.]. LIMIT to human and English language.

Cochrane: [(exp MeSH headings: Tachycardia, Supraventricular OR Atrial Fibrillation OR Atrial Flutter OR Tachycardia, Ectopic Junctional) OR SVT OR narrow complex tachycardia] AND [(exp MeSH heading Electrocardiography) OR ECG OR EKG] AND [exp MeSH headings Diagnosis, Differential OR Diagnosis] AND [speed OR velocity OR 25 mm$ OR 50 mm$].

Search strategy

EMBASE: [Supraventricular-tachycardia#.de. OR Tachycardia#.w..de. OR Reentry-Tachycardia#.de. OR Paroxysmal-supraventricular-tachycardia#.de. OR heart-arrhythmia#.de. OR Heart-atrium-fibrillation#.de. OR Tachycardia#.w..de. OR SVT.mp.] AND [Electrocardiography#.w..de. OR ECG-abnormality#.de. OR ECG.mp. OR EKG.mp. OR electrocardiogra$.mp.] AND [diagnos$.mp. OR differential$.mp.] AND [Time#.w..de. OR speed.mp. OR velocity.mp. OR 25 mm$.mp. OR 50 mm$.mp.]. LIMIT to human and English language.

CINAHL: [Tachycardia-supraventricular#.de. OR Arrhythmia#.w..de. OR Tachycardia#.w..de. OR Arrhythmia-atrial#.de. OR Tachycardia-atrial#.de. OR (narrow ADJ complex ADJ tachycardia).mp. OR SVT.mp.] AND [Electrocardiography#.w..de. OR ECG.mp. OR EKG.mp. OR electrocardiogra$.mp.] AND [diagnos$.mp. OR differential$.mp.] AND [Time#.w..de. OR speed.mp. OR velocity.mp. OR 25 mm$.mp. OR 50 mm$.mp.]. LIMIT to human and English language.

Search outcome
Using the reported searches, 116 papers were identified using OVID Medline, 216 using EMBASE, 8 using CINAHL, and 6 using Cochrane. Only one paper, which had been identified using both OVID Medline and EMBASE, was relevant to the three part question.

Comments
There is a subgroup of patients with narrow complex tachycardia who are difficult to diagnose using the initial 12-lead ECG. A trial of adenosine is often used to aid diagnosis but this often causes significant side effects to the patient and some quite literally heart stopping moments for patient and physician alike. The idea of a simple, quick, non-invasive test such as the 25 mm/s ECG to aid diagnosis is therefore attractive.

The only study to investigate the clinical utility of this strategy suggests that the addition of a 50 mm/s ECG to a standard 25 mm/s ECG improves diagnostic accuracy in narrow complex tachycardia. The study suggests that inappropriate use of adenosine may be reduced by implementing this strategy, as interpreters are more likely to correctly diagnose difficult tracings.
Lignocaine as a pretreatment to rapid sequence intubation in patients with status asthmaticus

Report by John Butler, Consultant
Search checked by Rupert Jackson, Consultant
doi: 10.1136/emj.2005.029058

Abstract
A shortcut review was carried out to establish whether pretreatment with intravenous lignocaine is of benefit in asthmatic patients undergoing rapid sequence intubation (RSI). Altogether 157 papers were found using the reported search, of which one presented the best evidence to answer the clinical question. The author, date, and country of publication, patient group studied, study type, relevant outcomes, results, and study weaknesses of these best papers are tabulated (table 3). It is concluded that there is no good evidence to support the use of lignocaine in this circumstance.

Clinical scenario
A patient attends the emergency department in status asthmaticus. On examination they have a sinus tachycardia at a rate of 150/min, an oxygen saturation of 92% on high flow oxygen, and a pCO2 of 7.0 kPa. Despite maximal medical treatment they are becoming exhausted. You decide that the patient needs an RSI and continuous mandatory ventilation. You wonder whether the pretreatment with lignocaine will attenuate the respiratory response (bronchospasm) to airway manipulation.

Three part question
In [asthmatic patients who need RSI and ventilation] does [pretreatment with intravenous lignocaine prior to RSI] reduce the incidence of [adverse airway responses]?

Search strategy


Steroids in sudden sensorineural hearing loss

Report by Angaj Ghosh, Registrar
Search checked by Rupert Jackson, Consultant
doi: 10.1136/emj.2005.029066

Abstract
A shortcut review was carried out to establish whether steroids are of benefit in sudden onset sensorineural deafness. Altogether 175 papers were found using the reported search, of which five presented the best evidence to answer the clinical question. The author, date, and country of publication, patient group studied, study type, relevant outcomes, results, and study weaknesses of these best papers are tabulated (table 4). It is concluded that there is insufficient good evidence to recommend early steroid treatment in this condition.

Clinical scenario
A 35 year old man presents to the emergency department with an 18 hour history of a right sided sudden hearing loss. Examination does not reveal a cause. A diagnosis of idiopathic sensorineural deafness is made. Your consultant suggests that a course of prednisolone might be of benefit. You discuss this with the registrar in audiological medicine who does not support this approach. You wonder who is right.

---

Table 3

<table>
<thead>
<tr>
<th>Author, date, country</th>
<th>Patient group</th>
<th>Study type</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Study weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maslow AD et al, 2000, USA</td>
<td>60 asthmatic patients undergoing intubation</td>
<td>Prospective randomised controlled trial</td>
<td>Lower pulmonary resistance</td>
<td>8.2 v 7.6 cm water [ns]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.5 mg/kg lidocaine v saline given 3 min before tracheal intubation</td>
<td></td>
<td>Frequency of airway response to intubation</td>
<td>6/30 v 5/27 [ns]</td>
<td></td>
</tr>
</tbody>
</table>
Table 4

<table>
<thead>
<tr>
<th>Author, date, country</th>
<th>Patient group</th>
<th>Study type</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Study weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilson WR and Byl FM, 1980, USA</td>
<td>Patients attending within 10 days of a 30 decibel sudden sensorineural hearing loss in at least 3 contiguous frequencies for whom no cause could be found.</td>
<td>Prospective double-blind trial, combining the results from two centres</td>
<td>Recovery of 50% of the original hearing loss</td>
<td>20/33 (61%) in steroid group and 11/34 (32%) in placebo group: significant 0.01&lt;br&gt;p = 0.025</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Moskowitz D et al, 1984, USA</td>
<td>Patients attending a private ENT clinic over a 10 year period with idiopathic sensorineural hearing loss (n = 54)</td>
<td>Prospective cohort</td>
<td>Recovery of 50% of the original hearing loss</td>
<td>24/27 (89%) with steroids and 4/9 (44%) without: statistically significant 0.005&lt;br&gt;p = 0.01</td>
<td>Not randomised</td>
</tr>
<tr>
<td>Cinamon U et al, 2001, Israel</td>
<td>41 patients with unilateral sensorineural hearing loss Randomised to prednisolone placebo tablets, carbogen inhalation or room air</td>
<td>Prospective randomised controlled trial</td>
<td>Early audiometric outcome</td>
<td>No difference</td>
<td>No power study</td>
</tr>
<tr>
<td>Kitajiri S et al, 2002, Japan</td>
<td>78 patients with sudden sensorineural hearing loss Normal treatment v normal treatment plus steroids 318 patients presenting with sudden unilateral sensorineural hearing loss over 10 years Steroid treatment v none (patients who refused)</td>
<td>Controlled trial</td>
<td>Recovery rate</td>
<td>81% v 79%</td>
<td>Non-randomised before and after design</td>
</tr>
<tr>
<td>Chen CY et al, 2003, Taiwan</td>
<td>Observational study</td>
<td>Recovery of hearing (pure tone average) in severe cases</td>
<td>Better in those on steroids</td>
<td>Non-randomised study describing outcomes in a centre committed to steroid treatment</td>
<td></td>
</tr>
</tbody>
</table>

Three part question
In [an adult with sudden idiopathic hearing loss] is [early steroid therapy better than no steroids] at improving [time to recovery and outcome]?

Search strategy
Medline OVID 1966 to week 4 June 2005. [{exp hearing loss, sudden/ OR sudden adj/ OR sudden adj hearing/ OR sudden adj hearing adj loss.mp.} AND {exp steroids/OR steroid/ OR exp glucosteroids/OR glucosteroid.mp. OR exp corticosteroid/ OR corticosteroid.mp.}] LIMIT to human, English language, and all adult.

Embase OVID 1980 to week 27 2005. [{exp sudden deafness/ OR sudden adj/ OR sudden adj hearing/ OR sudden adj hearing adj loss.mp.} AND {exp steroid/ OR steroid.mp OR exp glucocorticoid/ OR glucosteroid.mp. OR exp corticosteroid/ OR corticosteroid.mp.}] LIMIT to human, English language, and adult <18 to 64 years> or aged <65 years>.


Search outcome
 Altogether 175 unique papers were found of which five directly answered the question.

Comments
Idiopathic sudden sensorineural hearing loss has a high (50–70%) spontaneous partial or complete recovery rate; therefore, for a given treatment to be considered effective, a very high success rate must be demonstrated. The studies shown are all small and offer no convincing evidence of recovery rates above those expected.

► CLINICAL BOTTOM LINE
Current evidence does not support the early use of high dose steroids in idiopathic sensorineural hearing loss.


