

## BEST EVIDENCE TOPIC REPORTS

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

Edited by K Mackway-Jones

*Emerg Med J* 2005;22:729-733. doi: 10.1136/emj.2005.029033

Best evidence topic reports (BETs) summarise the evidence pertaining to particular clinical questions. They are not systematic reviews, but rather contain the best (highest level) evidence that can be practically obtained by busy practising clinicians. The search strategies used to find the best evidence are reported in detail in order to allow clinicians to update searches whenever necessary. Each BET is based on a clinical scenario and ends with a clinical bottom line, which indicates, in the light of the evidence found, what the reporting clinician would do if faced with the same scenario again. The BETs published below were first reported at the Critical Appraisal Journal Club at the Manchester Royal Infirmary<sup>1</sup> or placed on the BestBETs website. Each BET has been constructed in the four stages that have been described elsewhere.<sup>2</sup> The BETs shown here together with those published previously and those currently under construction can be seen at <http://www.bestbets.org>.<sup>3</sup> Four BETs are included in this issue of the journal.

- ▶ Diagnostic utility of electrocardiogram for diagnosing pulmonary embolism.
- ▶ Lignocaine as a pretreatment to rapid sequence intubation in patients with status asthmaticus.
- ▶ Steroids in sudden sensorineural hearing loss.
- ▶ Differential diagnosis of narrow complex tachycardias by increasing electrocardiograph speed.

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- 1 Carley SD, Mackway-Jones K, Jones A, *et al*. Moving towards evidence based emergency medicine: use of a structured critical appraisal journal club. *J Accid Emerg Med* 1998;15:220-2.
- 2 Mackway-Jones K, Carley SD, Morton RJ, *et al*. The best evidence topic report: a modified CAT for summarising the available evidence in emergency medicine. *J Accid Emerg Med* 1998;15:222-6.
- 3 Mackway-Jones K, Carley SD. bestbets.org: Odds on favourite for evidence in emergency medicine reaches the worldwide web. *J Accid Emerg Med* 2000;17:235-6.

## 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 rule in the diagnosis.

### Clinical scenario

A 30 year old man presents to the emergency department with a spontaneous onset of atraumatic 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

Medline OVID 1966 to week 4 June 2005 [exp Pulmonary Embolism OR exp THROMBOEMBOLISM OR PE.mp OR pulmonary infarct\$.mp OR Pulmonary Embol\$.mp] AND [exp Electrocardiography OR Electrocardio\$.mp OR ECG.mp OR EKG.mp]. LIMIT to human AND English. The Cochrane Library Issue 1 2005.

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

### Search outcome

Altogether 952 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.

**Rodger M**, Makropoulos D, Turek M, *et al*. Diagnostic value of the electrocardiogram in suspected pulmonary embolism. *Am J Cardiol* 2000;86:807-9.  
**Stollberger C**, Finsterer J, Lutz W, *et al*. Multivariate analysis-based prediction rule for pulmonary embolism. *Thromb Res* 2000;97:267-73.

Table 1

Author, date, country	Patient group	Study type	Outcomes	Key results	Study weaknesses
Rodger M <i>et al</i> , 2000, Canada	212 consecutive patients referred for V/Q or pulmonary angiogram for suspected PE	Prospective validation of previously derived scoring system	Prevalence of 28 ECG abnormalities in those subsequently diagnosed as PE positive (49) or negative (163)  Diagnostic utility of ECG scoring system (previously derived in patients diagnosed as PE positive) assessed for validation	Only 2 abnormalities (tachycardia and incomplete RBBB) significantly more prevalent in PE positive than PE negative patients  Positive and negative predictive values of scoring system 57.1 and 81.7, respectively	Small numbers (possibility of false negative results)
Stallberger C <i>et al</i> , 2000, Austria	168 (derivation) and 139 (validation) inpatients suspected of PE	Prospective derivation/validation study	Risk factors, objective clinical signs, LDH, ECG ('signs of right heart strain'), arterial blood gases, venography/plethysmography results and chest x ray recorded  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	Individual signs 16–48% sensitive for PE, 83–94% specific  PE score performance is reported for 17 different scores in paper. Examples are given below: PE score >0.3 Sn 100%, Sp 79%  PE Score >0.5 Sn 70%, Sp 99%	Small sample size  Inpatient population only
Miniati M <i>et al</i> , 2003, Italy	1100 consecutive patients referred for investigation for PE	Derivation/cross validation study	Objective signs, risk factors, ECG and CXR recorded. Multivariate logistic regression established those associated with the diagnosis of PE	Scoring system (included ECG signs of right heart strain) developed that divides patients into low, intermediate, moderately high, and high groups  Pre-test probability by group  Low 4% Intermediate 22% Moderately high 74% High 98%	Subjective inclusion criteria  No prospective validation study (cross validation only)
Richman PB <i>et al</i> , 2004, USA	Patients assessed for PE over 1 year. 49 with PE compared with 49 without	Observational	ECG changes classically associated with PE	Sinus tachycardia (18.8% v 11.8%), incomplete RBBB (4.2% v 0%), S1Q3T3 (2.1% v 0%) S1Q3 (0 v 0)	Incomplete cohort used in that 252 patients investigated for PE were not used in analysis
Sinha N <i>et al</i> , 2005, USA	Patients undergoing CT pulmonary angiography at a tertiary hospital over 30 months	Retrospective cohort	ECG changes significantly associated with PE	Sinus tachycardia (39% v 24%) S1Q3T3 (12% v 3%) Atrial tachyarrhythmias (15% v 4%) Q3 (40% v 26%) Q3T3 (8% v 1%)	

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

Miniati M, Monti S, Bottai M. A structured clinical model for predicting the probability of pulmonary embolism. *Am J Med* 2003;114:173–9.

Richman PB, Louti H, Lester SJ, *et al*. Electrocardiographic findings in emergency department patients with pulmonary embolism. *J Emerg Med* 2004;27:121–6.

Sinha N, Yalamanchili K, Sukhija R, *et al*. Role of the 12-lead electrocardiogram in diagnosing pulmonary embolism. *Cardiol Review* 2005;13:46–9.

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

Report by Joao Luis Gaspar, Medical student  
Search checked by Richard Body, Clinical Research Fellow

doi: 10.1136/emj.2005.029074

### 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

Table 2

Author, country, date	Patient group	Study type	Outcomes	Key results	Study weaknesses
Accardi AJ <i>et al</i> , 2002 USA	45 patients with difficult narrow complex tachycardia (heart rate range: 150–250 beats/min) 8 Emergency physicians reviewed the ECGs, blinded to clinical information.  Definitive diagnosis depended upon agreement between the 'official diagnosis' in the case notes and a cardiologist who reviewed each case.	Prospective comparative cohort	Correct ECG diagnosis  Correct ECG diagnosis of atrial flutter  Correct diagnosis of atrial fibrillation  Correct diagnosis of PSVT  correct diagnosis of sinus tachycardia	63% 25 mm/s standard group v 71% 50 mm/s ECG; difference in means 8.6% (95% CI 2, 15%); p=0.002  40% 25 mm/s standard group v 52% 50 mm/s ECG; difference in means 12.5% (95% CI 1, 24%); p=0.008  85% 25 mm/s standard group v 90% 50 mm/s ECG difference in means 4.5% (95% CI -5, 14%); p=0.046  73% 25 mm/s standard group v 78% 50 mm/s ECG; difference in means 5% (95% CI -6, 16%); p=0.18  56% 25 mm/s standard group v 81% 50 mm/s ECG	Small numbers  Definitive diagnosis was potentially inaccurate  Review of 25 mm/sec ECGs was followed by review of 50 mm/sec ECGs two weeks later. The reviewers may have learned more about ECG diagnosis in that time, biasing the results. Intraobserver variability should have been assessed

saturation 93% in air. A 12-lead ECG is recorded, which reveals a rapid narrow complex tachycardia. Interpretation of P wave activity is difficult because of the rapid heart rate and you cannot be entirely sure whether this is atrial flutter, junctional tachycardia, or sinus tachycardia. You wonder if increasing the ECG speed will help you to make a more accurate diagnosis.

### Three part question

In [adults with narrow complex tachycardia] does [increased electrocardiograph speed] improve [success in identifying the type of narrow complex tachycardia]?

### Search strategy

Medline OVID interface 1966 to week 1 July 2005. EMBASE using the Dialog Dastar interface 1974 to week 1 July 2005. CINAHL using the OVID interface 1982 to week 4 June 2005.

OVID: [exp Tachycardia, Supraventricular/OR exp Tachycardia, Paroxysmal/OR exp Atrial Flutter/OR exp Tachycardia, Atrioventricular Nodal Reentry/OR exp Tachycardia/OR exp Atrial Fibrillation/OR exp Tachycardia, Sinus/OR (narrow complex tachycardia OR SVT).mp.] AND [exp Electrocardiography/OR (ECG OR EKG OR electrocard).mp.] AND [exp Diagnosis, Differential/OR (diagnos\$ OR differential\$.mp.)] AND [exp Time Factors/OR speed.af. OR (25 mm\$ OR 50 mm\$ OR velocity\$.mp.)]. LIMIT to human and English language.

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 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 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 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 50 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.

### ► CLINICAL BOTTOM LINE

A 50 mm/s ECG should be considered when differential diagnosis of narrow complex tachycardia is difficult.

Accardi AJ, Miller R, Holmes JF. Enhanced diagnosis of narrow complex tachycardias with increased electrocardiographic speed. *J Em Med* 2002;22(2):123-6.

## 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 pCO<sub>2</sub> of 7.0 kPa. Despite maximal medical treatment they are becoming exhausted. You decide that the patient needs a 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 [pre-treatment with intravenous lignocaine prior to RSI] reduce the incidence of [adverse airway responses]?

### Search strategy

Medline OVID 1966 to week 4 June 2005. [exp Asthma OR exp Asthma, exercise induced OR asthma\$.mp OR exp Bronchial spasm OR bronchospasm.mp] AND [exp Lidocaine OR lidocaine\$ OR lignocaine\$ OR lignocaine.mp]. LIMIT to human, English language, and publication year 2000–2005.

Embase OVID 1980 to week 27 2005. [exp Asthma OR exp Asthma, exercise induced OR asthma\$.mp OR exp bronchospasm OR bronchospasm.mp] AND [exp Lidocaine OR lidocaine\$ OR lignocaine\$ OR lignocaine.mp]. LIMIT to human, English language, and publication year 2000–2005.

The Cochrane Library Issue 2 2005. [{Asthma MeSH }] AND [{bronchial spasm MeSH}] AND [{lidocaine MeSH OR lignocaine ALL FIELDS}]

### Search outcome

Altogether 157 papers were found in 2000–2005, of which 143 were unique, of which one was relevant to the question.

### Comments

Tracheal intubation in asthmatics is linked to the risk of life threatening bronchospasm. This reflex is in part neurally mediated through the vagus nerve. Local anaesthetics have been used as a pretreatment to airway stimulation in susceptible patients in the hope of attenuating the reflex induced bronchoconstriction. The National Emergency Airway Course recommends a pretreatment dose of intravenous lignocaine (3 mg/kg) given 3 minutes prior to intubation in this patient group. There is no evidence from the above trial that this will be of value. Interestingly pretreatment with albuterol did attenuate the response.

### ► CLINICAL BOTTOM LINE

There is no evidence for the use of lignocaine as a pretreatment agent in asthmatic patients needing an RSI.

Maslow AD, Regan MM, Israel E, *et al.* Inhaled albuterol, but not intravenous lidocaine, protects against intubation-induced bronchoconstriction in asthma. *Anesthesiol* 2000;93:1198–204.

## 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

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



Table 4

Author, date, country	Patient group	Study type	Outcomes	Key results	Study weaknesses
Wilson WR and Byl FM, 1980, USA	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.	Prospective double-blind trial, combining the results from two centres	Recovery of 50% of the original hearing loss	20/33 (61%) in steroid group and 11/34 (32%) in placebo group: significant 0.01 < p < 0.025	Not randomised
Moskowitz D <i>et al</i> , 1984, USA	Patients attending a private ENT clinic over a 10 year period with idiopathic sensorineural hearing loss (n = 36)	Prospective cohort	Recovery of 50% of the original hearing loss	24/27 (89%) with steroids and 4/9 (44%) without: statistically significant 0.005 < p < 0.01	Poor design Not analysed with intention to treat Short follow up Different steroids used Not randomised
Cinamon U <i>et al</i> , 2001, Israel	41 patients with unilateral sensorineural hearing loss Randomised to prednisolone placebo tablets, carbogen inhalation or room air	Prospective randomised controlled trial	Early audiometric outcome  Late audiometric outcome	No difference  No difference	No power study  Sample size not calculated
Kitajiri S <i>et al</i> , 2002, Japan	78 patients with sudden sensorineural hearing loss Normal treatment v normal treatment plus steroids	Controlled trial	Recovery rate  Time from start of treatment to improvement	81% v 79%  3.9 days v 3.7 days	Not blinded Small numbers Non-randomised before and after design
Chen CY <i>et al</i> , 2003, Taiwan	318 patients presenting with sudden unilateral sensorineural hearing loss over 10 years Steroid treatment v none (patients who refused)	Observational study	Recovery of hearing (pure tone average) in severe cases  Recovery of hearing (pure tone average) in milder cases	Better in those on steroids  No difference	Non-randomised study describing outcomes in a centre committed to steroid treatment

### 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 deaf\$.mp. OR sudden adj hearing adj loss.mp.}] AND [{exp steroids/OR steroid\$.mp. OR exp glucosteroids/OR glucosteroid\$.mp. OR corticosteroid\$.mp}]. LIMIT to human, English language, and all adult.

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

Cochrane Library Issue 2 2005. Steroids [MeSH all fields] AND hearing loss, sudden [Mesh all fields]

### 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.

**Wilson WR**, Byl FM, Laird N. The efficacy of steroids in the treatment of idiopathic sudden hearing loss. A double blind clinical study. *Arch Otolaryngol* 1980;**106**(12):772–6.

**Moskowitz D**, Lee KJ, Smith HW. Steroid use in idiopathic sudden sensorineural hearing loss. *Laryngoscope* 1984;**94**(5Pt1):664–6.

**Cinamon U**, Bendet E, Kronenberg J. Steroids, carbogen or placebo for sudden hearing loss: a prospective double-blind study. *European Arch Oto-Rhino-Laryngol* 2001;**258**:477–80.

**Kitajiri S**, Tabuchi K, Hiraumi H, *et al*. Is corticosteroid therapy effective for sudden-onset sensorineural hearing loss at lower frequencies. *Arch Otolaryngol Head Neck Surg* 2002;**128**:365–7.

**Chen CY**, Halpin C, Rauch SD. Oral steroid treatment of sudden onset sensorineural hearing loss: a ten year retrospective analysis. *Otol Neurotol* 2003;**24**:728–33.