BEST EVIDENCE TOPIC REPORTS

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

K Mackway-Jones

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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. The BETs published below were first reported at the Critical Appraisal Journal Club at the Manchester Royal Infirmary[1] or placed on the BestBETs web site. Each BET has been constructed in the four stages that have been described elsewhere.[2] The BETs shown here together with those published previously and those currently under construction can be seen at http://www.bestbets.org.[3] Six BETs are included in this issue of the journal.

- Oxygen therapy for uncomplicated myocardial infarction
- Gastric lavage in paracetamol poisoning
- Oral corticosteroids in acute urticaria
- Ice, pins, or sugar to reduce paraphimosis
- Intravenous aminophylline or salbutamol in moderate to severe asthma
- Hypertonic or isotonic saline in hypotensive patients with severe head injury

K Mackway-Jones, Department of Emergency Medicine, Manchester Royal Infirmary, Oxford Road, Manchester M13 9WL, UK; kevin.mackway-jones@man.ac.uk

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.

Oxygen in acute uncomplicated myocardial infarction

Report by Richard Body, *Senior House Officer*
Checked by Kerstin Hogg, *Clinical Research Fellow*

Abstract

A short cut review was carried out to establish whether supplemental oxygen reduces mortality in patients with uncomplicated acute myocardial infarction. Altogether 290 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 this best paper are tabulated. A clinical bottom line is stated.

Clinical scenario

A 60 year old man presents to the emergency department with acute severe crushing chest pain. ECG shows changes consistent with acute myocardial infarction. You prescribe aspirin, thrombolysis, nitroglycerin, β blockers, and high flow oxygen. You know that oxygen therapy is traditionally held to be beneficial in this situation, but wonder if there is any evidence that it reduces mortality.

Three part question

In [patients with acute uncomplicated myocardial infarction] does [oxygen therapy] lead to [reduced mortality]?

Search strategy

Medline 1966-10/03 using the OVID interface. [exp myocardial infarction OR myocardial infarct$.mp OR MI.mp OR heart attack.mp OR exp Coronary Thrombosis OR acute coronary syndrome.mp] AND [exp oxygen OR oxygen.mp OR O2.mp OR exp oxygen inhalation therapy] AND [exp Mortality OR exp Hospital Mortality OR mortality.mp OR exp Death OR death.mp] LIMIT to human AND English.

Search outcome

Altogether 290 papers were identified, only one of which was relevant to the question (table 1).

Comment(s)

The routine use of oxygen in myocardial infarction has been widely advocated for many years. However, the only study to investigate the efficacy of this approach was underpowered to show a difference in mortality.

► CLINICAL BOTTOM LINE

In patients with uncomplicated acute myocardial infarction there is no evidence that supplemental oxygen reduces mortality. However the there is no evidence of harm. Further research is required before changes in current practice should be recommended.

Rawles JM, Kenmure ACF. Controlled trial of oxygen in uncomplicated myocardial infarction. *BMJ* 1976;1:1121–3.

Gastric lavage in paracetamol poisoning

Report by Stewart Teece, *Clinical Research Fellow*
Checked by Kerstin Hogg, *Clinical Research Fellow*

Abstract

A short cut review was carried out to establish whether gastric lavage is better than activated charcoal in cases of poisoning with paracetamol. Altogether 63 papers were found using the reported search, of which four 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. A clinical bottom line is stated.

Table 1

Author, date and country	Patient group	Study type (level of evidence)	Outcomes	Key results	Study weaknesses
Rawles JM and Kenmure ACR, 1976, UK	157 patients with acute uncomplicated myocardial infarction Oxygen *v* compressed air via MC mask at 6l/min for 24 hours	PRCT	Incidence of arrhythmias	More sinus tachycardia in oxygen group ($p<0.05$); no other significant differences	No power calculation
			Number of patients given analgesics/number of doses given (diamorphine)	No significant difference	No assessment of pain scores
			Mortality	9 *v* 3 deaths (not significant)	Effect of implementing intention to treat analysis not discussed

Clinical scenario
A 26 year old woman attends the emergency department 40 minutes after having taken 80×500 mg paracetamol tablets. As the dose taken is high and within the past hour you wonder whether she would benefit from gastric lavage.

Three part question
In [paracetamol poisoning] is [gastric lavage better than activated charcoal or nothing] at [reducing hepatotoxicity]?

Search strategy
Medline 1966-10/03 using the OVID interface. [exp acetaminophen OR paracetamol.mp OR acetaminophen.mp] AND [exp poisoning OR poison$.mp OR exp overdose OR overdos$.mp] AND [exp gastric lavage OR gastric lavage.mp OR gastric decontamination.mp OR exp gastric emptying OR gastric emptying.mp OR exp irrigation OR washout.mp] LIMIT to human AND English.

Search outcome
Altogether 63 papers found of which 59 were irrelevant or of insufficient quality. Four of the remaining papers are shown in table 2, the fifth is a position statement mentioned in the comments section.

Comment(s)
The 1997 Joint Position Statement by the American Academy of Clinical Toxicology, European Association of Poisons Centres and Clinical Toxicologists stated gastric lavage should not be routinely used for poisoned patients. A similar statement from the British Poisons Centres indicates that gastric lavage is only to be used within 60 minutes of overdose and only with drugs not absorbed by charcoal.

► CLINICAL BOTTOM LINE
Gastric lavage is less effective than charcoal alone after paracetamol poisoning.

Underhill TJ, Greene MK, Dove AF. A comparison of the efficacy of gastric lavage, ipecacuanha and activated charcoal in the emergency management of paracetemol overdose. *Arch Emerg Med* 1990;**7**:148–54.
Buckley NA, Whyte IM, O'Connell DL, *et al*. Activated charcoal reduces the need for N-acetylcysteine after acetaminophen (paracetemol) overdose. *J Toxicol Clin Toxicol* 1999;**37**:753–7.
Grierson R, Green R, Sitar DS, *et al*. Gastric lavage for liquid poisons. *Ann Emerg Med* 2000;**35**:435–9.
Christophersen AB, Levin D, Hoegberg LCG, *et al*. Activated charcoal alone or after gastric lavage: a simulated large paracetamol intoxication. *Br J Clin Pharmacol* 2002;**53**:312–17.
Vale JA. Position statement: gastric lavage. American Academy of Clinical Toxicology; European Association of Poisons Centres and Clinical Toxicologists. *J Toxicol Clin Toxicol* 1997;**35**:711–19.

Oral corticosteroids in acute urticaria

Report by M Poon, *Paediatric Registrar*
Checked by C Reid, *Registrar*

Abstract
A short cut review was carried out to establish whether the addition of oral corticosteroids to antihistamines leads to a

Table 2

Author, date and country	Patient group	Study type (level of evidence)	Outcomes	Key results	Study weaknesses
Underhill TJ *et al*, 1990, UK	60 patients taken 5 g or more within 4 hours of attendance. Gastric lavage (14) *v* ipecacuanha(21) *v* activated charcoal(20) or nothing(5)	RCT	Plasma concentrations at 0, 1.0, 1.5. and 2.5 hours after treatment	39.3% reduction in concentration compared with 52.2% charcoal	Small Study
Buckley NA *et al*, 1999, Australia	981 consecutive paracetamol overdose. Gastric lavage and charcoal *v* charcoal alone *v* nothing	Observational study	Patients developing high risk concentrations	No statistically significant improvement with lavage + charcoal than charcoal alone.	
Grierson R *et al* 2000, Canada	10 volunteers given 4.0 g paracetamol. Gastric lavage at 1 hour compared with no treatment as crossover.	Crossover study	8 plasma concentrations over 8 hours	Reduction of 20% (95% CI 3% to 37%)	Small study. Low dose. Liquid paracetamol only
Christophersen AB *et al*, 2002, Denmark	12 volunteers given 50 mg/kg paracetamol. Lavage + charcoal *v* charcoal	Crossover study	12 plasma concentrations over 7 hours	Charcoal 66% reduction in concentration, lavage + charcoal 48.2%	Small numbers Low dose

more rapid resolution of urticaria. Thirty nine papers were found using the reported search, of which two 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. A clinical bottom line is stated.

Clinical scenario

A 4 year old girl presents to the emergency department with an urticarial rash. Her general practitioner has prescribed an oral antihistamine but the rash has persisted. You wonder if there is a role for oral corticosteroids in this otherwise well child.

Three part question

In a [child with acute urticaria] does the [addition of oral corticosteroids to antihistamines] lead to [more rapid resolution of symptoms].

Search strategy

Cochrane Database of Systematic Reviews Issue 3, 2003. Medline 1966-10/03 using the OVID interface. Cochrane: 'urticaria' Medline: [exp urticaria OR urticaria$.mp] AND [exp steroids OR steroid$.mp OR exp adrenal cortex hormones OR corticosteroid$.mp] AND [Randomized Controlled Trial.pt OR Controlled Clinical Trial.pt] LIMIT to human.

Search outcome

Cochrane Database of Sytematic Reviews—no relevant results. Medline search results—39 articles, of which two were relevant (table 3).

Comment(s)

There are no studies specifically aimed at children with acute urticaria. These limited trials demonstrate improvement in symptoms when prednisolone is prescribed, but larger studies are needed.

► CLINICAL BOTTOM LINE

In patients presenting to the emergency department with acute uricaria, the addition of oral prednisolone to an antihistamine results in decreased itch and more rapid rash resolution.

Pollack CV Jr, Romano TJ. Outpatient management of acute urticaria: the role of prednisone. *Ann Emerg Med* 1995;**26**:547–5.
Zuberbier T, Ifflander J, Semmler C, *et al*. Acute urticaria: clinical aspects and therapeutic responsiveness. *Acta Derm Venereol* 1996;**76**:295–7.

Ice, pins, or sugar to reduce paraphimosis

Report by Kevin Mackway-Jones, *Consultant*
Checked by Stewart Teece, *Clinical Research Fellow*

Abstract

A short cut review was carried out to establish which of the ice glove technique, the multiple puncture technique, or the application of sugar was the best approach for paraphimosis reduction. Thirty three papers were found using the reported search, of which three 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. A clinical bottom line is stated.

Clinical scenario

You are asked to see a 19 year old man who has presented to the emergency department with paraphymosis. He states that he fell asleep after sex the night before and woke up with swelling. Simple traction has failed to cure the problem (but has brought tears to his eyes). A surgeon, a specialist registrar in emergency medicine, and a urologist are already in attendance. The first says that multiple punctures should be made with a needle, the second that an iced glove should be used, and the third that sugar should be applied. You wonder whether any of the suggested methods are evidence based.

Table 3

Author, date and country	Patient group	Study type (level of evidence)	Outcomes	Key results	Study weaknesses
Pollack CV Jr and Romano TJ, 1995, USA	43 adult outpatients with acute urticaria given IM diphenhydramine then randomised to oral hydroxyzine plus either 20 mg prednisone 12 hourly for four days or placebo	RCT	10 point visual analogue itch score at 48 hours. Itch score at 5 days	Mean 48 hour itch score 1.3 in prednisone group *v* 4.4 in control group. Five day itch score 0 in prednisone group *v* 1.6 in control group	Adult patients only Small study No power calculation
			Description of rash at 48 hours and 5 days	No difference between groups at 48 hours. Rash resolved completely at 5 days in prednisone group	Rash not described at five days in control group
Zuberbier T *et al*, 1996, Germany	109 adult and paediatric patients with acute urticaria treated with loratidine 10 mg daily or prednisolone 50 mg daily for three days followed by loratidine 10 mg daily until remission of symptoms	Non-randomised prospective cohort study	Days until cessation of whealing	65.9% of had cessation of whealing by 3 days and a further 15.9% by 7 days in Loratidine group, compared with 93.8% by 3 days and a further 3.1% by 7 days in the prednisolone group. Resolution in all patients after >21 days. NNT with prednisolone for resolution of symptoms by 3 days = 4	Number of children unstated Different exclusion criteria between groups (potentially pregnant women excluded from loratidine group)

Three part question
In [an adult male with irreducible paraphimosis] is [ice better than multiple puncturing or sugar] at [reducing swelling and allowing reduction]?

Search strategy
Medline 1966-10/03 using the OVID interface. [paraphymosis.mp OR paraphimosis.mp OR exp paraphimosis OR (foreskin.mp AND retraction.mp)] AND [reduc$.mp OR exp ice OR ice$.mp OR puncture$.mp OR exp punctures OR sugar.mp].

Search outcome
Altogether 33 papers found, of which three were relevant (table 4).

Comment(s)
There are no comparative or randomised trials in this area. Current treatment is based wholly on custom, practice, and word of mouth. Further research is warranted.

► CLINICAL BOTTOM LINE
All three methods have been shown to work, but there is no evidence to show which is best. Local guidelines should be followed.

Houghton GR. The ''iced-glove'' method of treatment of paraphimosis. *B J Surg* 1973;**60**:876–7.
Gonzalez Fernandez M, Sousa Escandon MA, Parra Muntaner L. Sugar: treatment of choice in irreducible paraphimosis. *Actas Urol Esp* 2001;**25**:393–5.
Kumar V, Javle P. Modified puncture technique for reduction of paraphymosis. *Ann R Coll Surg* 2001;**83**:126–7.

Is intravenous aminophylline better than intravenous salbutamol in the treatment of moderate to severe asthma?

Report by Andrew Munro, *Registrar*
Checked by Michelle Jacobs, *Specialist Registrar*

Abstract
A short cut review was carried out to establish whether intravenous salbutamol or intravenous aminophylline offers the quickest and least complicated treatment for patients with moderate to severe asthma not responding to inhaled therapy. Altogether 71 papers were found using the reported search, of which nine 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. A clinical bottom line is stated.

Clinical scenario
A 20 year old man is brought to the emergency department in acute respiratory distress with asthma. He has a history of poor compliance with unstable asthma and several hospital admissions in the past. His old notes are available and you notice whenever intravenous treatment has been started he has been given aminophylline. You feel that the best drug is a β_2 agonist and that if it is not getting to the receptors via the airways then intravenous is the next best route. There is some dismay among the nursing staff when you formulate an intravenous regimen. They say they have never given it before. You wonder whether your approach is evidence based.

Three part question
In [patients with moderate to severe asthma resistant to inhaled β_2 agonists] does [IV aminophylline or IV salbutamol] result in [quicker relief with less side effects]?

Search strategy
Medline 1966-10/03 using the OVID interface. [(exp albuterol/OR salbutamol.mp) AND intravenous.mp] AND [exp asthma/OR exp bronchial spasm/OR exp bronchoconstriction/OR bronchoconstriction.mp] AND [exp aminophylline/OR aminophylline.mp OR exp theophylline/OR theophylline.mp] LIMIT to human AND English.

Search outcome
Altogether 71 papers found of which 62 were considered irrelevant or of insufficient quality for inclusion. The remaining nine papers are shown in table 5.

Comment(s)
Multiple small trials of reasonable quality show intravenous salbutamol to be as good if not better at reversing obstructive airflow in asthmatic patients. Those studies that were equivocal used drug regimens that could be considered subtherapeutic or confounded. Side effects, although present seem to be well tolerated. Recent or high powered trials comparing the two drugs do not exist.

► CLINICAL BOTTOM LINE
Intravenous salbutamol should be considered a first line agent in the acute management of severe asthma in adults.

Beswick K, Davies J, Davey AJ. A comparison of intravenous aminophylline and salbutamol in the treatment of severe bronchospasm. *Practitioner* 1975;**214**:561–6.
Williams SJ, Parrish RW, Seaton A. Comparison of intravenous aminophylline and salbutamol in severe asthma. *BMJ* 1975;4:685.
Tribe AE, Wong RM, Robinson JS. A controlled trial of intravenous salbutamol and aminophylline in acute asthma. *Med J Aust* 1976;**2**:749–52.
Femi-Pearse D, George WO, Ilechukwu ST, *et al.* Comparison of intravenous aminophylline and salbutamol in severe asthma. *BMJ* 1977;1:491.
Johnson AJ, Spiro SG, Pidgeon J, *et al.* Intravenous infusion of salbutamol in severe acute asthma. *BMJ* 1978;1:1013–15.
Evans WV, Monie RD, Crimmins J, *et al.* Aminophylline, salbutamol and combined intravenous infusions in acute severe asthma. *Br J Dis Chest* 1980;**74**:385–9.

Table 4

Author, date and country	Patient group	Study type (level of evidence)	Outcomes	Key results	Study weaknesses
Houghton GR, 1973, UK	10 patients with paraphimosis aged 8–91 years. Iced glove placed for five minutes	Case series	Reduction	9 of 10	Small numbers No controls
Gonzalez FM *et al*, 2001, Spain	Three patients with paraphimosis Application of granulated sugar for one to two hours	Case series	Reduction	All reduced	Small numbers No controls
Kumar V and Javle P, 2001, UK and India	45 patients with paraphimosis Multiple puncture in patients with glans engorgement (39)	Case series	Reduction	All reduced if no skin changes	Small numbers No controls

Table 5

Author, date and country	Patient group	Study type (level of evidence)	Outcomes	Key results	Study weaknesses
Beswick K *et al*, 1975, UK	20 patients in GP setting with acute bronchospasm	Single blinded randomised trial of IV salbutamol or aminophylline	Vital signs PEFR FEV_1 FVC	Same Difference favouring salbutamol at 10 and 20 min but not significant	Small non-ED study (most treated at home)
			Side effects	Significantly worse profile for aminophylline	
Williams SJ *et al*, 1975, Wales	20 acute asthmatic patients with peak flow <25% predicted, Pao_2<68 mm Hg	DBRCT One hour infusion of either 500 μg aminophylline or 500 g salbutamol	Peak flow Pulse	Increased but not significant for salbutamol More tachycardia (significant) with salbutamol	Small numbers
			BP	Fall in diastole	
			Side effects	Less tremor, nausea, no difference in plasma [K+]	
Tribe AE *et al*, 1976, Australia	23 acute asthma patients	DBRCT of IV aminophylline *v* salbutamol	Spirometry	Non-significant benefit and peak effect of aminophylline	Suboptimal dose of salbutamol
			ABG	Quicker improvement in oxygen tension with salbutamol	Variable pre-trial treatment
Femi-Pearse D *et al*, 1977, Nigeria	50 patients with peak flow <165l/min	Single and double blinded trials of salbutamol and aminophylline	Five minutely pulse and peak flow measures	Significant benefit in peak flow at 5 min ($p<0.005$) and 20 min ($p<0.05$) for single blinded trial only for salbutamol. No difference in pulse rate	Small trial Low dose of salbutamol
Johnson AJ *et al*, 1978, UK	39 of 62 acute asthmatic patients unresponsive to initial IV 10 min aminophylline infusion and nebulised salbutamol	Single blinded RCT Either 1 mg/min aminophylline or 10 μg/min salbutamol	Peak expiratory flow FEV1	Non-significant benefit of aminophylline Non-significant benefit of salbutamol	All received IV aminophylline initially No initial bolus of salbutamol
			FVC	Non-significant benefit of aminophylline	Variable used of nebulised salbutamol acutely
			Arterial gas measurements	No difference	Not blinded to physicians
			Pulse and BP	Significant tachycardia in salbutamol group	Variable background preventive treatment
Evans WV *et al*, 1980, UK	21 acute asthma patients	Single blinded RCT comparing aminophylline, salbutamol or combined IV	Spirometry	Non-significantly quicker time to improvement with aminophylline and combined infusion	Small numbers Variable baseline severity Sub-therapeutic salbutamol dosing
Sahay JN *et al*, 1984, UK	20 adults with FEV_1<70% predicted	Double blinded RCT crossover of aminophylline, terbutaline and salbutamol	Spirometry	All produced significant improvement, salbutamol significantly better than aminophylline to 30 min after dose then no difference with better peak effect.	Small group, not acutely unwell
			Vital signs and side effects	Salbutamol significantly more tachycardia and palpitations which return to no difference at 90 min	
Sharma TN *et al*, 1984, India	30 known asthmatic patients with acute bronchospasm	RCT of aminophylline, salbutamol or terbutaline	Spirometry	Salbutamol significantly better FEV_1	Blinding not clear
			Side effects	Significantly more palpitations with salbutamol	Salbutamol 250 μg given as 1 min bolus
Grief J *et al*, 1985, Israel	21 patients (mean age 38 years) with acute or chronic asthma	Single blinded crossover 20 min infusion of salbutamol or aminophylline	% Increase in peak flow	Salbutamol shows significant benefit to 30 min ($p<0.01$) and 45 min ($p<0.05$) after infusion	Small study
			Pulse rate	Tachycardia with salbutamol	
			BP	No difference	Not fully blinded
			Plasma [K+]	Average drop of 0.6 mmol/l	
			Tremor	More in salbutamol group	

Table 6

Author, date and country	Patient group	Study type (level of evidence)	Key results	Outcomes	Study weaknesses
Wade CE *et al*, 1997, Sweden	223 patients with severe head injuries and hypotension. 250 ml 7.5% NaCl/6% Dextran 70 (single bolus) *v* standard care (usually Ringer's lactate)	Cohort analysis from six previous PRCTs	24 hour survival	Odds ratio of 1.92 (p=0.06) for survival 24 hours with HS	Heterogeneous trials, which were not all designed to assess head injured patients
			Discharge Survival	Odds ratio of 2.12 (p=0.048) for survival until discharge with HS	Long term outcome not assessed
Shackford SR *et al*, 1998, USA	34 patients with severe head injuries and undergoing ICP monitoring. 1.6% NaCl (HS) *v* Ringer's lactate (RL) to treat ''episodes of haemodynamic instability'' during initial resuscitation and for 5 days	PRCT	ICP	No significant difference between groups. Maximum ICP fell 9.1 mm Hg with HS and rose 2.5 mm Hg with RL ($p<0.05$)	CPP not addressed
			Number of interventions to control increased ICP	Average of 31 interventions per patient with HS *v* 11 interventions with RL ($p<0.01$)	HS group had more severe injuries
			Glasgow Outcome Score at discharge	No significant difference	Small numbers: a power study indicated the need for 320 patients but only 34 were enrolled
Simma B *et al*, 1998, Switzerland	32 children with severe head injury and ICP monitoring. 1.6% NaCl (HS) *v* Ringer's lactate (RL) as only IV fluid for 3 days following injury.	PRCT	ICP and CPP Number of interventions to control increased ICP	No significant difference Average of 44 interventions per patient with HS *v* 62 per patient with RL. ($p<0.02$)	Small numbers: the power calculation was directed towards detecting a difference in ICP
			Na concentration and ICP	Inverse correlation ($p<0.3$) in both groups	
			Na concentration and CPP	Inverse correlation significant only in HS group after 8 hours (p=0.002) otherwise N/S	
			Length of ICU stay	Shorter ICU stay: 11.6 *v* 8.0 days (p=0.04)	Increase in ICP treated by stepwise increase therapy, thus not surprising that no difference in ICP seen
			Complications	Higher incidence in RL group (N/S)	
			Ventilation times	Longer duration in RL group (N/S)	
			Length of hospital stay Survival	No significant difference No significant difference	

Sahay JN, Bell R, Chatterjee SS, *et al*. Comparative study of effects of intravenous administration of aminophylline, salbutamol and terbutaline in patients suffering from reversible airways obstruction. *Curr Med Res Opin* 1984;**9**:1–6.
Sharma TN, Gupta RB, Gupta PR, *et al*. Comparison of intravenous aminophylline, salbutamol and terbtaline in acute asthma. *Indian J Chest Dis Allied Sci* 1984;**26**:155–8.
Grief J, Markovitz L, Topilsky M, *et al*. Comparison of intravenous salbutamol (albuterol) and aminophylline in the treatment of acute asthmatic attacks. *Ann Allergy* 1985;**55**:504–6.

Hypertonic or isotonic saline in hypotensive patients with severe head injury

Report by Rupert Jackson, *Consultant*
Checked by John Butler, *Consultant*

Abstract
A short cut review was carried out to establish whether hypertonic or isotonic saline improved the outcome most in patients with severe head injury. Altogether 66 papers were found using the reported search, of which three 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. A clinical bottom line is stated.

Clinical scenario
You are resuscitating a 30 year old man with a severe closed head injury. His GCS was 3 on admission. He is intubated and ventilated and a CT scan is being organised. His blood pressure is only 90/40 mm Hg. You want to improve cerebral perfusion by giving intravenous fluid but are aware that too much fluid might worsen cerebral oedema. You wonder whether there would be any advantage in giving hypertonic saline.

Three part question
In [patients with severe head injury and low blood pressure] is [hypertonic saline better than isotonic fluids] at [increasing

cerebral perfusion, reducing intracranial pressure and improving outcome]?

Search strategy

Medline 1966-10/03 using the OVID interface. [exp hypertonic solutions/or exp saline solution, hypertonic/or ''hypertonic saline''.mp.] AND [exp craniocerebral trauma/OR ''head injury''.mp. OR ''HEAD INJURIES''.mp. OR exp head injuries, closed/OR ''head injured''.mp. OR exp brain injuries/OR ''brain injury''.mp.]

Search outcome

Altogether 66 papers were found of which three were trials of sufficient quality that addressed the three part question. These are displayed in table 6.

Comment(s)

All three trials showed some improvements in patients with head injury treated with hypertonic saline compared with standard care. The largest showed a two times survival advantage in those treated with hypertonic saline but this was a cohort analysis rather than a PRCT. It is not established how much hypertonic saline should be given and when. A large randomised controlled trial would help to establish the role of hypertonic saline.

► CLINICAL BOTTOM LINE

There is insufficient evidence at present to justify the use of hypertonic saline as resuscitation fluid in patients with severe head injury.

Wade CE, Grady JJ, Kramer GC, *et al.* Individual patient cohort analysis of the efficacy of hypertonic saline/dextran in patients with traumatic brain injury and hypotension. *J Trauma* 1997;**42**(suppl 5):61–5.
Shackford SR, Bourguignon PR, Wald SL, *et al.* Hypertonic saline resuscitation of patients with head injury: a prospective, randomized clinical trial. *J Trauma* 1998;**44**:50–8.
Simma B, Burger R, Falk M, *et al.* A prospective, randomized and controlled study of fluid management in children with severe head injury: lactated Ringer's solution versus hypertonic saline. *Crit Care Med* 1998;**26**:1265–70.