

NIV mortality in clinical practice - the 2008 UK national COPD audit

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Introduction

A synthesis of the evidence collated from Randomised Controlled Trials (RCTs) has shown excellent survival rates for patients with acute acidotic respiratory failure treated with NIV¹. The 2003 UK National COPD audit in contrast suggested much poorer outcomes for patients treated in usual clinical practice². The 2008 national audit collected further data to explore the circumstances around the use of NIV and the mortality rates in usual clinical practice.

Methods

All UK acute hospitals admitting COPD patients were invited to participate in the audit programme between March and May 2008. Prospective case ascertainment with retrospective case note audit was used to collect data on process of care and outcomes on up to 60 consecutive admissions. Data were entered onto a web based collection tool with results collated centrally.

Results

232 UK hospitals representing 96% of all UK secondary care Trusts collected clinical data including information about NIV on 9716 patients. 1678 (20%) patients were acidotic on admission and a further 465 (7%) became acidotic later in the admission (Table 1). 1077 patients received NIV.

24% of acidotic patients treated with NIV died during the admission with 33% dead at 90 days follow up. Patients treated with NIV whose lowest recorded arterial pH was at admission had lower mortality than patients whose lowest pH was recorded later in the admission. Patients with a normal admission pH who developed later acidosis fared worst of all (Table 2). Those with a low bicarbonate were more likely to die in hospital than those with either a high or normal bicarbonate (38%/25%/22%).

21% of NIV patients had radiological pneumonia and 35% of these died during admission (Table 2). Only 3% of patients receiving NIV who subsequently died went on to be intubated and mechanically ventilated. Only 5% of all acidotic patients were treated with mechanical ventilation with 140 hospitals not mechanically ventilating a single patient included in the study period.

Tables

Table 1: Arterial blood gas results as recorded in the national audit for the 3 acidotic patient subgroups

		All cases on admission		ACIDOTIC on admission, this being the lowest pH (group 1)		ACIDOTIC on admission, later lowest pH ALSO ACIDOTIC (group 2)				NON-ACIDOTIC on admission, later lowest pH ACIDOTIC (group 3)			
						On admission		Later		On admission		Later	
pH	<7.26	7%	N=8215 557	35%	N=1225 427	29%	N=453 130	60%	N=453 272	-	N=465 0	32%	N=465 151
	7.26-7.34	14%	1121	65%	798	71%	323	40%	181	-	0	68%	314
	7.35+	80%	6537	-	0	-	0	-	0	100%	465	-	0
	Median (IQR)	7.41	(7.36-7.45)	7.29	(7.22-7.32)	7.30	(7.25-7.32)	7.24	(7.18-7.27)	7.39	(7.36-7.41)	7.29	(7.23-7.32)
Bic	<23	14%	N=7826 1096	16%	N=1144 187	14%	N=438 61	17%	N=432 73	11%	N=452 48	23%	N=445 101
	23-30	65%	5104	51%	584	44%	191	39%	168	57%	256	46%	204
	>30	21%	1626	33%	373	42%	186	44%	191	33%	148	31%	140
	Median (IQR)	26	(24-30)	28	(24-32)	29	(25-34)	29	(24-35)	28	(25-32)	27	(23-32)
PCO ₂	≤ 6.0	56%	N=8229 4628	9%	N=1197 107	5%	N=453 24	4%	N=452 16	39%	N=462 182	11%	N=465 49
	> 6.0	44%	3601	91%	1090	95%	429	96%	436	61%	280	89%	416
	Median (IQR)	5.8	(4.9-7.2)	8.8	(7.3-10.9)	9.0	(7.6-10.5)	10.3	(8.7-12.4)	6.5	(5.4-7.6)	8.7	(7.3-10.1)
PO ₂	<7.3	21%	N=8231 1691	19%	N=1200 230	35%	N=453 158	24%	N=450 109	38%	N=462 176	24%	N=463 113
	7.3-8.0	14%	1125	7%	87	9%	41	9%	39	13%	60	10%	47
	>8.0	66%	5415	74%	883	56%	254	67%	302	49%	226	65%	303
	Median (IQR)	8.9	(7.6-11.3)	10.4	(7.9-14.8)	8.6	(6.5-11.9)	9.3	(7.5-12.5)	8.0	(6.6-9.7)	9.1	(7.3-11.5)

Table 2. Outcomes for 1077 patients receiving NIV according to timing of acidosis, arterial blood and presence of radiological findings consistent with pneumonia

3 main Patient subgroups:	NO Pneumonia (CXR)						Pneumonia (CXR)					
	Inpatient mortality		90 Day mortality		LOS discharges		Inpatient mortality		90 Day mortality		LOS discharges	
	%	N	%	N	Median	N	%	N	%	N	Median	N
ACIDOTIC on admission, this being the lowest pH (group 1)	18	61/344	29	96/326	9	199	24	21/89	31	27/86	10	68
ACIDOTIC on admission, later lowest pH ALSO ACIDOTIC (group 2)	23	61/260	30	74/249	8	283	35	20/57	38	21/56	9	37
NON-ACIDOTIC on admission, later lowest pH ACIDOTIC (group 3)	39	61/156	42	65/143	12	95	40	25/63	44	27/62	16	38
ALL PATIENTS receiving NIV	24	203/854	32	264/814	9	651	30	67/223	35	76/217	11	156

* within 90 days from index admission

Conclusions

The high mortality observed in 2003 was demonstrated again in 2008. A high proportion of patients are severely acidotic on admission and a proportion has accompanying pneumonia. A further group of patients admitted with a normal pH become acidotic later some with a mixed metabolic/respiratory acidosis and have a particularly poor prognosis. Very few patients progress to invasive mechanical ventilation. It appears that NIV is being used as a ceiling of treatment in severely ill patients who historically would either not receive ventilatory support at all or would be treated within an Intensive Care Unit setting and receive invasive mechanical ventilation. These observations should stimulate a review of the current use of NIV that has extended outside of the evidence base of RCTs.

References:

- Ram FS, Picot J, Lightowler J, Wedzicha JA. Non-invasive positive pressure ventilation for treatment of respiratory failure due to exacerbations of chronic obstructive pulmonary disease. Cochrane database of systematic reviews (online) 2004; (3) CD004104
- Kaul S, Pearson M, Coultis I, Lowe D, Roberts CM. Non-Invasive Ventilation (NIV) in the Clinical Management of Acute COPD in 233 UK Hospitals: Results from the RCP/BTS 2003 National COPD Audit. COPD: Journal of Chronic Obstructive Pulmonary Disease, 6:171-176

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