

Acidosis in COPD exacerbations admitted to hospital - the UK National COPD Audit 2008

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Introduction

There are few data from large scale studies on the prevalence of acidosis in patients admitted with COPD. There are theoretical and practical concerns about the relationship of type II respiratory failure with the administration of high flow oxygen therapy. We present here data from the 2008 UK National COPD Audit programme that describes the relationship between admission acidosis and administered oxygen.

Methods

Within the scope of the 2008 UK National audit hospital units were asked to report data on up to 60 consecutive COPD admissions between March and May 2008. A prospective case ascertainment with retrospective case note audit using a web based collection tool was used. Amongst the data items were those relating to arterial blood gases and oxygen therapy.

Results

232 hospitals (96% of all UK National Health Service Acute Trusts) returned data on 9716 patients, 50% were male, mean age 73yrs. 87% of cases had admission arterial blood gases (ABG) taken. 20% of admission ABGs were acidotic (pH<7.35) and 7% had a pH of <7.26. When recorded, in 30% of cases the FiO₂ at the time of blood gases was >.28. In 52% of cases the FiO₂ of oxygen given in the ambulance prior to admission was recorded and in 30% of cases this was >.35. The relationship between the timing of administration of high flow oxygen and the prevalence of acidosis is strong (Table 1). Some of these patients went on to exhibit worsening acidosis whilst others recovered (Table 2). A further 7% of non-acidotic admissions had an acidotic pH recorded later in the admission, with an overall prevalence of acidosis at any time of 26% amongst all admissions. The median time to lowest pH in this latter group was recorded at 12 hours post admission, 64% of these patients were receiving oxygen at an FiO₂ >.28 at the time.

High flow oxygen administration was associated with subsequent ventilatory support (22%, 331/1491 vs 9%, 336/3561) and with higher in hospital mortality (11.1% 165/1491 vs 7.2%, 256/3561). Patients who were acidotic on admission having received high flow oxygen were also more likely to die in hospital than acidotic patients who did not receive high flow oxygen (16.9%, 88/522 vs 14.9%, 60/403).

Tables

Table 1: Relationship between the interval since high flow oxygen was received and the degree and prevalence of acidosis and hypoxia in the admission arterial blood gas

Proportion of cases with:	pH <7.35 on admission		PaO ₂ ≤8.0 on admission	
	%	N	%	N
No high flow oxygen received	14	403/2942	38	1143/2983
High flow oxygen received before blood gases taken:				
>60 minutes before gases	20	107/537	39	211/538
>15 but ≤ 60 minutes before gases	36	127/350	34	120/352
≤15 minutes before gases	52	44/85	33	28/85
Still receiving High flow oxygen when gases taken	52	244/471	11	53/479

Table 2: 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)			
		%	N	%	N	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)

Discussion

A fifth of patients admitted with COPD demonstrated acidosis at the time of admission. There is a significant relationship between the timing of the administration of high flow oxygen and the presence of acidosis. A second group of patients admitted with a normal range pH become acidotic a median of 12 hours into the admission. A high proportion of these patients also received high flow oxygen. Whilst it is not possible to categorically state that oxygen administration was the cause of the acidosis in these patients they demonstrate a very different clinical course from acidotic patients not administered high flow oxygen. Caution should be exercised in the administration of oxygen both pre and during admission. Patients developing severe hypoxia require careful monitoring during the period of increased oxygen delivery having an increased risk of ventilatory failure and death.

