Blue breath holding is benign

J B P Stephenson

Southall et al described 51 infants and young children with recurrent episodes of cyanosis and loss of consciousness of whom 'eight died suddenly and unexpectedly'. The authors alleged that 'these cyanotic episodes [which] included both intrapulmonary shunting and prolonged expiratory apnoea . . . are a cause of sudden unexpected death in infancy and early childhood'. Many readers will have inferred that the message of this article is that blue breath holding attacks carry a mortality, indeed a mortality of 16%.

I have recently had the opportunity to review the clinical features and mechanisms of the many syncopes and anoxic seizures that afflict the young. In terms of outcome, these tend to fall into one of two groups, the hazardous and the benign. First there are those fits or faints in which a treatable component should be recognised by the doctor to avoid a substantial risk of brain damage or death. Examples include those anoxic seizures induced by forcible smothering and those associated with ventricular tachyarrhythmias or sick sinus syndrome. Secondly there are those syncopes in which a negative feedback or fail safe mechanism normally operates, with automatic recovery however horrific the episode appears to the observer. Here, the doctor's main function is to provide reassurance and dissolution of parental anxiety. In this benign group I have placed breath holding attacks (cyanotic and 'mixed') and so called 'reflex anoxic seizures' (previously called 'white breath holding' attacks). Indeed, the cornerstone of management of breath holding spells is that one says to the parents that these attacks will not do harm, echoing well established opinion.

Southall et al appear to have reached fundamentally different conclusions. The writer of one editorial has interpreted their data as demonstrating a 15% mortality in a disorder perceived as similar to but not identical to breath holding. It is therefore important to determine first whether the patients reported in the papers of Southall et al did have breath holding spells as usually understood, and if so whether their paper contains the scientific basis for breath holding spells having a high mortality and being a mechanism for sudden infant death.

Is breath holding the subject matter?

Southall et al specified that 'In all 51 patients most of the cyanotic episodes began when the child was awake, usually after a naturally occurring stimulus such as pain, fear or anger resulting in a cry or an attempt to cry . . . Episodes commonly began with a series of expiratory cries without inspiratory efforts, often with a widely open mouth. Sometimes an episode began with a single prolonged cry that was silent, the expiratory apnoea beginning immediately'.

The authors stated that such episodes 'have been previously described as cyanotic breath
holding attacks', with a 'presentation . . . iden-
tical to that described as “cyanotic breath-
holding”' 1,2 but as some have doubted this identi-
ty I have sought further clarification.
During a recent scientific meeting (Scottish Cot 
Death Trust SIDS Research meeting, 
Royal College of Physicians and Surgeons of Glasgow, 
28 November 1989) Dr David Southall agreed
that the patients he was talking about had 'identi-
cal cyanotic episodes to those which I had
recorded on videotape.

This videotape was of two typical breath holding spells in a 15 month old girl as illus-
trated in the figure. To make this meaningful to
the clinical reader, the history is briefly sum-
marised:

Breath holding spells began aged 7 months, five days 
after diphtheria, pertussis, and tetanus immunisation.
Their frequency varied from two to six or more daily.
Rarely there had been two days without spells, but more
usually the interval was two hours. Provocations inclu-
ded being frightened or her mother going out of the
room, but were not always obvious. The parents' 
description was 'starts to cry, doesn’t really cry, no cry
come out, goes blue bluey-red darkish, stiffens up arms
out straight, head back, unconscious'. Because some of
these breath holding spells were followed by rhythm-
atic limb twitching for up to three minutes ('anoxic-epileptic'
seizures), 2 videorecording and cassette elec-
troencephalography (EEG)/electrocardiography (ECG)
recording was undertaken. A total of 15 spells were
recorded, all anoxic rather than anoxic-epileptic.
Continuous rapid (3 per second) expiratory grunting led to
rapid cyanosis and opisthotonus with EEG flattening
within 40 to 45 seconds. Vocalisation was then followed
by a stare and chewing while the EEG showed high
voltage slow waves; alertness returned about 70 seconds
after onset. The ECG showed bradycardia with asystole
of 2-8 seconds beginning just before first signs of hypo-
xic EEG change, but this had no obvious additional effect
on the clinical or EEG changes and atropine did not pre-
vent the appearance of the spells in their usual form.
Ocular compression induced simultaneous 2-3 per
second expiratory gasping and asystole for 7 seconds,
with no obvious loss of consciousness and only minor
EEG slowing (2-2.5 cycles per second for 4 seconds). At
the age of 25 years spells continued at the same rate, but
the parents did not wish treatment. The child showed
strong personality and good intelligence.

Is cyanotic breath holding dangerous?
In a previous paper Southall et al state: 'The
rapid onset of severe hypoxaemia suggest[s] that
this form of apnoea [cyanotic breath holding]
may be an important cause of sudden
death . . . . the fact that none of the subjects
reported here has died leaves the relation to
SIDS open to further investigation'. 9

This recent paper provides no scientific sup-
sport for the suggestion that there is an excess of
sudden unexpected death in those with prior
breath holding spells. 1 There is no means by
which the reader can tell from what population
the 51 infants and young children who form the
subject matter originated. Of the four children
who are said to have died in a cyanotic attack,
one had a repaired tracheo-oesophageal fistula,
one a cleft palate, and the remaining two suf-
fered developmental delay and (iatrogenic)
tracheostomy. Of these two latter children one
(case 23) must surely have had primary progres-
sive cerebral atrophy (but the neuropathology is
not reported), and the details of the other (case
18) are totally inadequate. As the only case in
which extraordinary intrapulmonary shunting is
suggested by the very limited evidence pro-
vided, case 18 surely must be published in full.

Four additional boys are cited as having died
suddenly and unexpectedly after earlier typical
breath holding attacks. One was found to have a
brainstem glioma. 10 In the remaining three, there
are no population data or other way of
knowing whether this coincidence was improb-
able, that is, not expected by chance. My only
surprise is that more examples were not dis-
covered.

There is a potential second hypothesis (not ex-
plicitly introduced in the opening to the article
by Southall et al) that a novel form of intra-
pulmonary shunting is the basis of cyanotic
breath holding spells, but is not clear why their
results cannot be explained by a combination
of low lung volume and rapid oxygen
consumption. 3

A third hypothesis, combining these two, is
that intrapulmonary shunting is a mechanism
for sudden death. As I have alluded to above,
the terminal events in case 18 seem to bear pre-
cisely on this question. Adequately documented
details would allow the reader to judge this
issue.

Literature review
Southall et al appear to ignore the extensive stu-
dies on breath holding spells undertaken by
the authors of yesteryear, whether on prognosis 6
7 or regarding mechanism. 11 12 13 The extensive
studies of Gault et al 2 receive no mention.
No consideration is given to the observation that
apparently vagal mediated asystole may
occur in a child who also has cyanotic breath
holding on other occasions. 6 7 13 Nor to the
observation that vagal asystole may also be a
part of so called 'mixed' breath holding, as in
the figure.

Clinical criticisms
The authors clearly believed the parents that
their children’s episodes were life threatening,
and the death of a number of children would
bolster that belief: 'Investigations . . . . and
uncontrolled trials of treatment were considered
essential . . . . the need for resuscitation [my ita-
lics], and ethical concerns limited the informa-
tion that could be collected'. 1 It is a difficult and
delicate area in which to venture (the more so
with the authors’ dedication to four of the chil-
dren) but the question has to be asked, if the
prognosis was worse than expected from pre-
vious studies, whether any aspect of manage-
ment might have tilted the balance in an adverse
direction. It has long been known that tracheos-
tomy does not prevent cyanotic breath holding. 12

Future studies
I am not convinced that Southall et al have
demonstrated an excess mortality from breath
holding spells in otherwise healthy children.
None the less hints of autonomic disturbanc
may deserve further study, provided investigators—even in the face of daily and severe attacks—can withstand the temptation to ‘resuscitate’ or give uncontrolled treatments. Insufficient attention has been paid to the neurological basis of the active expiration which is an essential feature of breath holding attacks, but which may also be seen in those pallid synapses (associated with cardiac asystole) induced by ocular compression in the laboratory. Obviously the oculorespiratory reflex is no more involved in natural breath holding than is the oculocardiac reflex in those ‘reflex anoxic seizures’ mediated by cardiac asystole, but it can be studied safely and ethically and is not confined to man. What is self evident is that if continued brainstem neuronal drive is necessary to inhibit active inspiration and/or cardiac systole, then sufficient hypoxia and/or ischaemia must reverse this inhibition.

Summary
In their recent publication in this journal, Southall et al described typical cyanotic breath holding spells, both in otherwise healthy children and in those with brainstem lesions and other malformations. Their suggestions regarding possible autonomic disturbances may require further study, but they have adduced no scientific evidence to contradict the accepted view that in the intact child blue breath holding spells are benign.

Those families in which an infant suffers an ‘apparently life threatening event’ deserve immense understanding and help, and it behoves investigators to exercise extreme care and self criticism in the presentation of new knowledge which may bear upon their management and their morale.


Cyanotic ‘breath holding’ and sudden death

M P Samuels, D G Talbert, D P Southall

Dr Stephenson raises an important issue concerning the risk of sudden death during cyanotic breath holding. Our recent paper describes investigations to understand further the pathophysiological mechanisms responsible for severe cyanotic breath holding and did not attempt to estimate the risks of this disorder. To do this would require a population based study, ideally prospective in nature, in which there was almost complete follow up. The historical studies mentioned by Dr Stephenson are unable to confirm that no deaths occurred. Thus in the study of Laxdal et al and Lombroso and Lerman, 18% and 43% respectively were lost to follow up. One possible reason for a lack of response to posted questionnaires might have been the death of a child.

We trusted that readers would not automatically infer from reading our paper that there is mortality of 16% in cyanotic breath holding. As stated, our patients were at the severe end of the spectrum and therefore not representative of the whole population of ‘breath holders’. Furthermore, Hunt in his recent editorial did not claim that 15% of breath holders died, but was specifically referring to our collection of cases. Our cases were ‘selected’ by virtue of their referral to us by their paediatrician who, with the parents, was concerned about the severity of the hypoxaemic episodes.

Dr Stephenson omits to mention our own prospective population based study of sudden deaths between 1 and 5 years of age. This involved the follow up of 9856 infants all of whom were tagged for future death by the Office of Population Censuses and Surveys. Two of the deaths between 1 and 5 years in these 9856 children occurred during cyanotic breath holding. Based on Lombroso and Lerman’s estimated incidence of cyanotic breath holding as 2–8% of all children, around 276 of our 9856 cohort should have suffered from this