Chest radiograph showing inadvertent intubation of the right main bronchus.

The photographs of ventilation, the apparatus for needle cricothyroidotomy, and the gum elastic bougie were taken by Ashworth Assaye, medical illustration department, *BMJ*. The illustrations of the technique of intubation were reproduced from *A Systematic Guide to Intubation* (by P Lotz, F W Anfeld, and W K Hirlinger) by kind permission of the publisher, Atelier Flad, Eckental, West Germany, and the line drawings were prepared by the education and medical illustration services department, St Bartholomew's Hospital.

After intubation ventilation should proceed with a tidal volume of about 10 ml/kg at a rate of about 10 breaths each minute. Analysis of arterial blood gases should be undertaken at the first opportunity to reassess oxygenation and the adequacy of ventilation. Radiography of the chest should also be performed routinely after endotracheal intubation to catalogue the position of the endotracheal tube in the bronchial tree.

In conclusion, providing oxygen and ventilatory support as early as possible are prerequisites for successful resuscitation in victims of major trauma. Otherwise, as Haldane observed, hypoxia not only stops the machine but wrecks the machinery.

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The ABC of Major Trauma has been edited by Mr David Skinner, FRCS; Mr Peter Driscoll, FRCS; and Mr Richard Earlam, FRCS.

Controversies in Therapeutics

Management of urinary tract infection and vesicoureteric reflux in children

1 Operative treatment has no advantage over medical management

R H R White

The management of urinary tract infection in childhood has two principal aims: the relief of symptoms and the prevention of renal damage. The symptoms associated with urinary tract infection derive mainly from the lower urinary tract and are due to detrusor instability and urethral mucosal irritation. Vesicoureteric reflux probably plays little part in generating such symptoms, although gross reflux with extreme ureteric dilatation may create a substantial residual urine volume after voiding and encourage both urinary tract infection and instability. Treatment of symptoms has been described elsewhere^{1,2} and consists, essentially, of the appropriate antibiotic coupled with dietary correction of constipation—which invariably accompanies recurrent urinary tract infection but is usually unrecognised—and advice on voiding practices aimed at ensuring complete emptying of the bladder.

It is sometimes claimed that children with unrelieved vesicoureteric reflux are more likely to have recurrent acute pyelonephritis, although I am unaware of published data to support this. The basis for diagnosis is insecure, and presentation with acute loin pain and tenderness, fever, and vomiting is uncommon in childhood. In my experience, alleged loin pain often proves to be related to an overloaded colon. Although symptoms may cause misery, it is the renal scarring associated with vesicoureteric reflux (reflux nephropathy) that carries the most potentially serious long term health risks, being the commonest single cause of both renal hypertension and chronic renal failure in childhood.

Reflux nephropathy results from the reflux of infected urine into the renal parenchyma by means of pyelotubular backflow.³ Not all children are born with

EDITORIAL COMMENT

The clearest message to come from these two conflicting articles is that neither medical nor surgical treatment will be of much value if initiated too late. Appropriate investigation and accurate diagnosis at an early age, ideally earlier than 2 years, seem to be a crucial factor in determining outcome. The prospect of diagnosing reflux by antenatal

ultrasonography is appealing but must be a long way removed from routine clinical practice. Once the diagnosis is established the relative merits of surgery over medical treatment do not impress me so far as the results of prospective analysis are concerned. Endoscopic management sounds attractive but to introduce this technique without a prospective and randomised trial would be inappropriate.—PETER C RUBIN, *professor of therapeutics, University of Nottingham*

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Br Med J 1990;300:1391-2

The principal organs and vascular and urino-genital systems of a woman, c 1507 by Leonardo da Vinci

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refluxing papillae, which explains why some of those with vesicoureteric reflux never develop scarring. Intrarenal reflux is not observed after the age of 5 years, and the radiological discovery of fresh renal scarring after 7 years of age is exceptional. As intrarenal reflux is neither reliably diagnosable nor remediable the treatment must necessarily focus on the prevention of bacteriuria or the surgical correction of vesicoureteric reflux.

Surgical versus medical management

Although a vast experience of both prolonged chemoprophylaxis and ureteric reimplantation has been gained, claims for their respective benefits were until recently based on uncontrolled and often retrospective evidence. Since 1975 the Birmingham Reflux Study Group has prospectively compared operative and non-operative treatment of severe vesicoureteric reflux by random allocation.^{4,5} Non-operative treatment consisted of low dosage chemoprophylaxis until reflux had resolved or for a maximum of five years. Patients undergoing ureteric reimplantation also received chemoprophylaxis until reassessed two years after the operation.

The question posed was whether surgical treatment had additional benefits to those of medical management. No differences were found in terms of the frequency of breakthrough urinary tract infection, renal function, renal growth, and the development of new or progressive scarring. Moreover, the incidence of new and progressive scarring bore no relation to the presence or absence of breakthrough urinary tract infection and the radiological changes observed at the two year assessment were probably the outcome of a disease process that had started before entry to the study. Children aged 6 years or more at entry had poor renal growth in scarred kidneys, whereas younger children showed a degree of catch up growth between 2 and 5 years of age.

Two main conclusions emerge from these studies. Firstly, operative treatment has no advantage over

medical management; and secondly, treatment must be started at least by the age of 5 years if renal growth and function are to be preserved. It is noteworthy that half of the ureters managed medically in our series still showed vesicoureteric reflux after five years, whereas the operative success rate was 98%. Long term follow up studies in Cardiff have clearly shown, however, that the function of an individual kidney is related to the presence or absence of scarring and not to the reflux itself,⁶ and it is becoming increasingly apparent that the persistence of vesicoureteric reflux into adulthood is harmless.

Treatment strategy

At first sight the choice of treatment for vesicoureteric reflux thus remains arbitrary, dictated in individual cases by such factors as the ability to comply with prolonged chemoprophylaxis and the availability of surgical skill.⁷ The findings in Birmingham suggest, however, that two years' chemoprophylaxis may be beneficial in terms of subsequent renal growth, even in cases managed surgically. Furthermore, it cannot be assumed that the high technical success rates achieved by experienced paediatric surgeons will necessarily be attained in a district general hospital. Given the facts, most discerning parents will opt for at least a two years' trial of chemoprophylaxis. The cure of reflux by endoscopic submucosal teflon injection offers a seemingly attractive alternative to open surgery,⁷ but there is no reason to suppose that it can influence the upper renal tract more favourably than conventional surgery. Moreover, it has not yet been subjected to a controlled, prospective trial and some anxiety remains that fragments of teflon may migrate and cause granulomas in remote organs.

Ransley and Risdon have shown experimentally that renal scarring associated with reflux is initiated by the first urinary tract infection, and that prompt and vigorous antibiotic treatment may ameliorate it.⁸ The high incidence of scarring that we found in infants entering our study suggests that this is true of humans, and the diagnosis and treatment of children less than 5 years old should constitute a medical emergency. If there is any place for surgical treatment of reflux it must surely be before the advent of the first urinary tract infection. Such surgery requires even greater skill and experience when performed during infancy, while the small urethral calibre limits the use of teflon injection. Unfortunately, vesicoureteric reflux is rarely diagnosed until urinary tract infection has already occurred, and conventional cystourethrography is too invasive and costly for routine neonatal screening. The transient urinary dilatation that is often detected by antenatal ultrasonography might, however, represent reflux⁹ and afford a further opportunity for preventive management.

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