Prince Andrew married Sarah Ferguson on July 23rd 1986. That day also saw the first use in the United Kingdom of non-invasive positive pressure ventilation by nasal mask. Aged about fifty years, the patient had suffered pulmonary tuberculosis as a youngster and, in the days before anti-tuberculous chemotherapy, had been treated with bilateral pneumothoraces, phrenic crush and finally an apical thoracoplasty. As a result, he had a severe restrictive ventilatory defect but, because in his early years he had ignored the advice of his physicians and smoked for a while, he also suffered a degree of airflow obstruction and emphysema. By the early 1980s he had chronic Type II respiratory failure with massive fluid retention despite very high doses of diuretics. Cyanosed, sleepy and water-logged, he was referred to the Brompton Hospital for a trial of negative pressure ventilation using a tank ventilator. The effect was remarkable, with something like a 12 litre diuresis in the first 24 – 48 hours. A slimmer, pinker and much more talkative patient emerged and thereafter was maintained for a year or two in reasonable health - and always good spirits - by using a ‘portable’ iron lung at home during sleep. He also returned to work as a jeweller. But the value of negative pressure ventilation at night was compromised by a tendency to upper airway obstruction while asleep: gradually he drifted back into “cor pulmonale”. A further short respite was secured by adding oxygen while he used the iron lung but, even with ventilatory assistance for much of each day, it was eventually clear he was losing ground.

At about this time, an Australian physician on sabbatical in the Department of Medicine joined one of my ward rounds and mentioned he was aware Colin Sullivan, in Sydney, had assisted a patient through an episode of Guillain-Barre syndrome by using a phasic system of continuous positive airway
pressure by nasal mask, a technique he himself had popularised as treatment for sleep apnoea.

The difference between ventilating a patient with paralysed chest wall and normal lungs and my patient with a severe combined restrictive and obstructive ventilatory defect was all too clear and yet the potential was clearly so great – comparable to the massive leap forward created by the advent of positive pressure ventilation via an endotracheal or tracheostomy tube during the polio epidemic of the 1950s. I had the additional advantage of a background in cardiothoracic anaesthesia and intensive care and had spent many years using conventional positive pressure ventilation in patients with extreme forms of respiratory insufficiency. This experience made it possible to identify the mechanical characteristics which might be required if a non-invasive technique of positive pressure ventilation was to be developed.

A small, portable ventilator which could be powered by battery or from the mains was chosen and, on the Sunday before attempting to ventilate a patient, I spent an uncomfortable afternoon in the hospital laboratory finding out how to ventilate myself, suffering considerable abdominal distension in the process. But, armed with this experience, I offered the new method on a trial basis to my ‘difficult patient’ and he accepted with alacrity. Our experiments on July 23rd 1986 were interrupted by the excitement of half watching the royal wedding on the ward TV (there were no personal sets in those days), followed by a ‘celebratory lunch’ for all the patients which included a small bottle of wine for each. I could hardly believe the huge flow rate and volume of air this man requested to feel adequately ventilated but he was right, as became clear when arterial blood gas measurements were made. He never looked back thereafter although he did return from time to time with chest infections. During one such episode, he told me on admission that he had used his ventilator continuously for the past three days. “But how did you eat and drink” I asked, having previously told him specifically he must never do either while using his machine. “Well, I had to” he said “I was so breathless without it”. “What did you have” asked I – “fish and chips” came the answer, the patient meanwhile looking like a naughty schoolboy caught out in some
mischief. Doctors learn from their patients and it was clear that a sensitive trigger which allows the patient to initiate and terminate each assisted breath also permits more or less normal co-ordination of swallowing and breathing. Eventually the deprivations of his lung disease got the better of this man but not until the 21st century and he was within eighteen months or so of his 70th birthday; non-invasive ventilation – mostly with the positive pressure technique - had given him something like another 20 years of good quality life – and he never ever had any anti-tuberculous chemotherapy.

In those early days, the availability of ventilators for patients to use at home during sleep was curtailed by the need for the prescribing hospital to finance their supply and servicing. This made for some hard choices. But with healthcare purchased by Primary Care Trusts, the funds came from outside the hospital and the success of the technique meant it ‘took off’ in explosive fashion. It has been adopted too in the hospital ward setting and is now used widely for the treatment of acute respiratory failure, particularly exacerbations of chronic obstructive pulmonary disease. The advantages of avoiding endotracheal intubation include less risk of superinfection, less need for specialised intensive care facilities, less cost and quicker recovery. Intermittent assistance can be provided easily during recovery and patients also benefit from the boost to morale of being able to communicate freely. Of course, not all patients in need of mechanical ventilation can be treated effectively using the non-invasive technique and it can also create problems if, for example, those with progressive neurological disease are provided with ventilatory assistance on which they may eventually become entirely dependent while all other motor function is lost.

But, looking back on a very diverse career, I feel I can say with confidence that introducing non-invasive positive pressure ventilation by nasal mask was the single most important – and probably worthwhile – action for which I was ever responsible.

Margaret Branthwaite, April 2009.