Could early parenteral nutrition prior to emergency laparotomy be cost effective?

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There are around 30,000 emergency admissions for small bowel obstruction (SBO) in the United Kingdom every year. While obstructed, the patient is unable to eat normally, and this may last for several days The timing of initiation of parenteral nutrition (PN) in this population lacks a coherent evidence base and there is clinical equipoise. As part of the development process for designing a trial of early PN in this population we developed a mathematical model to estimate its potential cost-effectiveness. Such pre-trial modelling can indicate the value of the research and highlight important data requirements that the trial can address.

A decision tree was constructed to describe the care pathway for emergency admissions relating to (SBO). The events described by the tree are spontaneous resolution of obstruction, surgery, return to theatre, admission to intensive care, readmission, deep vein thrombosis, cardiac complications and death.

Model inputs came from four sources; the National Audit of Small Bowel Obstruction (NASBO), National Health Service (NHS) Reference costs, the Office for National Statistics and the academic literature. The daily cost of PN (£112) is based on a micro-costing study by Raper and colleagues with adjustments for inflation and overheads.

Costs relate to the NHS costs only. Health outcomes are measured in terms of quality adjusted life-years (QALYs) of the patients. A lifetime horizon is used, which based on a mean age of 68 and a 50:50 gender split, translates to 17.34 years. Costs and QALYs are discounted at 3.5% per annum. Prices are at 2015/16 levels. Incremental cost-effectiveness ratios (ICERs) below £30,000 are considered to be cost-effective.

Based on an assumed relative risk (RR) of 0.85 attributable to early PN for fatal and non-fatal complications, the analysis shows that PN costs around £2000 per patient, however, a lower rate of complications reduces this to a net cost of around £1300 per patient. Total costs are £10,130 per patient receiving early PN vs £8,781 for standard care. Early PN generates more QALYs (9.302 vs 9.202), with the resultant ICER being £13,549.

Scenario analysis investigating the effect of different RRs for complications shows that if the RR of mortality is below 0.9, PN is cost-effective regardless of the impact on non-fatal complications (Table 1). PN is borderline cost-effective when the RR of mortality is 0.95 and the RR of non-fatal complications is 0.8-0.85.

Table 1: Incremental cost-effectiveness ratios (£ per QALY gained) based on different scenarios of relative risk of complications

		Relative risk of fatal complications			
		0.95	0.9	0.85	0.8
Relative risk of non-fatal complications	0.95	45,013	23,393	15,802	11,931
	0.9	39,813	21,415	14,647	11,129
	0.85	35,298	19,582	13,549	10,358
	0.8	31,340	17,878	12,506	9,616

The use of PN in this patient population has the potential to be cost-effective. A randomised controlled trial would resolve most of the uncertainties relating to the estimation of cost-effectiveness. Given the size of the patient population, the research has the potential to generate huge benefits to the NHS.

References

Raper S, Milanov S, Park GR. The cost of multicompartment 'big bag' total parenteral nutrition in an ICU. Anaesthesia 2002; 57: 96-7.