Predicting optimal REBOA length from anatomical surface measurements

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INTRODUCTION: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is an emerging technique to control life-threatening haemorrhage. An endovascular balloon is placed within the aorta, via the common femoral artery (CFA), in one of three 'zones': between the left subclavian artery (LSA) and coeliac trunk (CT) ('zone 1'); CT and most distal renal artery (RA) ('zone 2'); or most distal RA and aortic bifurcation ('zone 3'). The length of insertion required for the balloon to lie within each zone must be estimated during the procedure. This study aimed to develop a method for predicting this length.

MATERIAL & METHODS: The distances from the pubic symphysis (PS) to the umbilicus, xiphisternum, and suprasternal notch (SN); and from the mid-inguinal point (MIP) to the PS, umbilicus and xiphisternum were recorded on forty embalmed cadavers. Each was dissected to reveal the relevant vasculature, and the lengths from each CFA to the most distal RA, the CT, and the LSA were recorded.

RESULTS: The distances from each CFA to the LSA were significantly correlated with the distance from the PS to SN (r=0.585, $p \leq 0.001$). The distances from each CFA to the remaining vessels were weakly correlated with the distance from the PS to the umbilicus ($r \geq 0.352$, $p \leq 0.05$). An endovascular balloon inserted a length equal to the distance from the PS to: midway between the SN and xiphisternum; two-thirds of the way from the umbilicus to the xiphisternum; and one-third of the way from the umbilicus to the xiphisternum, would have been located in 'zone 1' in every case (100%); 'zone 2' in 18/40 (45%); and 'zone 3' in 37/40 (93%) respectively.

CONCLUSIONS: The distances from the PS to midway between the SN and xiphisternum, and from the PS to one-third of the way from the umbilicus to the xiphisternum, may be used to estimate insertion length for 'zone 1' and 'zone 3' respectively. However, due to its small size and variable vasculature, insertion length for 'zone 2' is difficult to predict.