INTRODUCTION: Dysphagia is a well-recognized complication following anterior cervical plating, observed as high as 25% at two years follow up. Esophageal injury due to surgical retraction is one mechanism by which dysphagia may ensue. There are limited published data evaluating the effect of soft tissue retraction on intra-esophageal pressures during anterior cervical instrumentation and there are no validated outcome instruments evaluating dysphagia following elective anterior cervical approaches. The purpose of this study, therefore, was to 1) measure the intra-esophageal pressure secondary to retraction during anterior plating, 2) determine if any pressure differences exist between plating and cervical disc replacement, 3) determine if there is any difference between hand-held and self-retaining retraction, and 4) whether the surgical level or length of the plate influences the magnitude of intra-esophageal pressure during retraction.

METHODS: Using a 4 cm transverse incision centered on the C4/5 disc space, a left-sided, Smith-Robinson anterior approach to the cervical spine was performed on seven fresh frozen cadavers. The appropriate surgical level was confirmed prior to skin incision and after exposure of the cervical spine with fluoroscopic imaging. Correct placement of an esophageal pressure-transducing catheter, 180cm length, 3mm diameter, sensitivity range +/- 250mmHg with 4 circumferential sensors positioned 5cm apart (Medtronic, Memphis, TN) was confirmed using a laryngoscope, manual palpation of the esophagus and fluoroscopic imaging. Three surgical instrumentation groups were used for comparisons: 1) Single-level plate (Synthes CSLP, Paoli, PA), 2) single-level Porous Coated Motion (PCM) cervical disc replacement (Cervitech, Rockaway, NJ) and 3) 3-level anterior plate (Orion, Medtronic, Memphis, TN). Separate analyses were performed for instrumentation of the C3/4 and C5/6 spinal levels for each of the above groups. Hand-held appendiceal retractors were used to hold the soft tissues medially during screw insertion into the plate and during application of the PCM implant into the interspace. Care was taken to exert just enough force on the retractors to allow the surgeon to get the desired implant into the correct position. Fluoroscopy confirmed that the pressure sensors were directly behind the retractors during data acquisition using Esophageal Manometry System (Medtronic, Memphis, TN) and Polygraph for Windows® software.
RESULTS: Significantly greater intra-esophageal pressures were demonstrated for single-level cervical plating at C5/6 compared to C3/4 (p=0.02). Similarly, there was significantly greater pressures recorded at C5/6 versus C3/4 for the 3-level plating group (p=0.024). In contrast, there was no statistically significant difference in pressures observed during disk arthroplasty at C5/6 compared to C3/4 (p=0.56). Significantly greater pressures were recorded during single-level plating compared to disc replacement at both C3/4 (p<0.05) and C5/6 (p<0.05). 3-level plating demonstrated significantly greater pressures at C5/6 compared to disk arthroplasty (p<0.05) but no statistically significant difference compared to disk arthroplasty at C3/4 (p=0.05). The highest mean pressure, 130±52mmHg, was recorded at C5/6 level during insertion of the 3-level plates.

CONCLUSIONS: Based upon the data presented herein, anterior cervical plating results in significantly greater intra-esophageal pressures when performed at C5/6 compared to C3/4. This holds regardless of whether the plate spans the distance from C3 to C6 (3-level plate) or spans the single C5/6 level. In addition, the insertion of the PCM disc replacement appears to require less esophageal retraction and hence reduced intra-esophageal pressures when compared to anterior cervical plating. This is because cervical plating requires more retraction to insert the contralateral drill, tap, and/or screws which are usually inserted at a convergent angle. The disk arthroplasty requires retraction to the midline only whereas the arthrodesis techniques require exposure enough to enable an additional 15 degree or more convergent screw trajectory. A comparison was also made between hand held retractors and fixed Caspar and Cloward self-retaining retractors which anchor to the longus colli muscles—there was no significant difference in any group between self-retaining and hand held retraction. Further investigation using the same measuring technique will be performed to ascertain whether these relationships will be maintained intraoperatively in clinical use.

If noted, the author indicates something of value received. The codes are identified as: a- research or institutional support; b- miscellaneous funding; c- royalties; d- stock options; e- consultant or employee; n- no conflicts disclosed, and * disclosure not available at the time of printing. For full information, refer to inside of back cover.

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