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Heterotopic Ossification Following Cervical Total Disc Replacement: Iatrogenic or Constitutional?

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Objectives: To elucidate etiological factors of heterotopic ossification (HO) by evaluating retrospectively if HO is a unique finding following cervical total disc replacement (CTDR) or a finding observable following different surgical procedures in the anterior cervical spines such as anterior cervical interbody fusion (ACIF).

Material and methods: This retrospective study included 70 patients who consecutively underwent anterior cervical surgery (CTDR or ACIF) for degenerative cervical spine diseases between April 2004 and October 2006, and could be followed up more than 24 months. CTDR was performed using Bryan or ProDisc-C and ACIF using a RABEA PEEK stand-alone cage or fibular allograft with Atlantis plate and screws system by a single surgeon (C. K. P.). The presence of HO was determined by observing plain radiography at the last follow up. The relation between HO occurrence and specific preoperative radiological findings (osteophyte and calcification of posterior longitudinal ligament (PLL)) at the index level was investigated.

Results: CTDR (single-level in 35, double-level in 2) was performed in 37 patients and a total level was 39 (Bryan: 19, ProDisc-C: 20) and ACIF (single-level in 25, double-level in 7, 3-level in 1) was performed in 33 patients and a total level was 42 (cage: 29, plate: 13). Mean follow-up period was 29.1 months (CTDR: 28.1, ACIF: 30.4). HO was demonstrated at 26 levels (26/81: 32.1%): HO at 20 levels (all is index level: 51.3%) in CTDR group and at 7 levels (16.7%) in ACIF group (inter-group difference; P< 0.05). In subgroup analysis, HO was demonstrated at 10 levels (10/19: 52.6%) in Bryan subgroup, and at 10 levels (10/20: 50%) in ProDisc -C subgroup (inter-group difference; P>0.05). The stand-alone cage subgroup presented HO in 6 levels (6/29: 20.7 %), and the plate subgroup showed HO in only one (1/13: 7.7%) (intergroup difference; P< 0.05).

Among 6 levels of CTDR group which presented preoperative osteophyte at the operated level (Bryan; 4, Prodisc-C; 2), 3 levels showed HO (Bryan; 2, Prodisc-C; 1). Among 10 levels presenting osteophyte of ACIF group (cage; 7, plate; 3), 6 levels showed HO (cage; 5, plate; 1). Preoperative PLL calcification at the operated level was observed in 9 levels in CTDR group (Bryan: 5, ProDisc-C: 4), and all these cases showed HO. In ACIF group, among 8 levels showing the preoperative PLL calcification at the operated level (cage; 5, plate; 3), 3 levels presented HO (all stand-alone cage).

Conclusions: In the present study, HO was observed in both CTDR and ACIF groups. HO was more frequently occurred in CTDR group regardless of prosthesis type. In ACIF group, the stand-alone cage subgroup showed higher incidence of HO than the rigidly fixed plate subgroup. The results herald that not only iatrogenic factor such as postoperative biomechanical stress but constitutional properties such as preoperative calcification of longitudinal ligaments and osteophyte also play important role in the process of HO formation.