D-dimer: A Potential Serum Biomarker for Diagnosis of Periprosthetic Joint Infection

Alisina Shahi, MD, Philadelphia, PA
Michael M. Kheir, BS, Philadelphia, PA
Timothy Tan, MD, Philadelphia, PA
Antonia Chen, MD, MBA, Philadelphia, PA
Javad Parvizi, MD, FRCS, Philadelphia, PA

BACKGROUND: The diagnosis of periprosthetic joint infection (PJI) remains a challenge. Recent studies have demonstrated that synovial biomarkers have a promising role in the diagnosis of PJI with excellent accuracy. However, there are many disadvantages to the use of synovial markers for diagnosis of PJI as obtaining the synovial fluid is invasive, carries the potential for introducing infection into the joint, and not infrequently there is an issue with obtaining adequate fluid from the joint for analysis. There is a dire need for a more accurate serum biomarker for PJI. D-dimer is a widely available serum biomarker that detects fibrinolytic activities. Recent studies have shown that D-dimer levels also increase in the presence of infection. The hypothesis of this study was that the level of serum D-dimer would be elevated in patients with PJI.

MATERIALS AND METHODS: We conducted a prospective study in March 2015 to investigate the preoperative D-dimer (ng/mL), erythrocyte sedimentation (ESR) (mm/hr), and serum C-reactive protein (CRP) (mg/dL) levels of consecutive primary and revision total joint arthroplasties at our institution. PJI was defined using the Musculoskeletal Infection Society criteria. Patients with active ulcer, history of recent trauma (within two weeks), dislocations, and hypercoagulation disorders were excluded. This cohort includes 21 primary and 21 revision arthroplasties of which 13 were for aseptic failures and eight had PJI. There were two patients who were undergoing reimplantation after a prior resection arthroplasty.

RESULTS: The mean D-dimer level was significantly higher in PJI patients (1089.1 ng/mL ±379.4) compared to primary (215.4 ng/mL ±92.0, p=0.0011) and aseptic revisions (329.0 ng/mL ±173.5, p=0.0036). D-dimer levels in the two patients who were undergoing reimplantation was also low at 418 ng/mL and 461 ng/mL. When 800 ng/mL was assumed as the threshold level for PJI, all aseptic patients were below the cut-off and septic patients were above it (figure 1). The mean CRP level was higher in PJI patients (9.9 mg/L ±9.3) compared to primary (0.4 mg/L ±0.4, p=0.0054) and aseptic revisions (0.3 mg/L ±0.2, p=0.0082). ESR levels followed the same pattern but did not reach statistical significance, 53.6 mm/hr ±33.5 in PJI patients compared to 16.05 mm/hr ±9.7 and 14.6 mm/hr ±9.3 in primary and aseptic revisions, respectively (P>0.05).

CONCLUSION: Based on the data from this ongoing study, it appears that the serum D-dimer may be a promising marker for PJI. It may also have a great utility for determining the optimal timing of reimplantation. The study will continue to recruit more patients, especially those undergoing reimplantation surgery to assess the final utility of this test as a valuable marker for diagnosis and monitoring of PJI.