Protein profiling for periprosthetic joint infection

By Jennie McKee

FIVE MOLECULAR MARKERS HAVE POTENTIAL TO IMPROVE DIAGNOSTIC TESTING

Molecular markers may enable easier and more accurate diagnosis of periprosthetic joint infection (PJI), according to the results of a study presented by Javad Parvizi, MD, FRCS, at the 2011 AAOS Annual Meeting.

Because currently available tests for PJI are costly, cumbersome, and lack specificity regarding whether component failure is septic or aseptic, Dr. Parvizi and his fellow researchers used biomarker immunoassays to "investigate the role that protein profiling might play in improving the ability to diagnose PJI quickly and accurately."

The investigators identified five inflammatory proteins in synovial fluid that have the potential to serve as diagnostic markers for infection.

"This prospective study using biomarker immunoassays has demonstrated promising results for the use of molecular markers in the diagnosis of PJI," said Dr. Parvizi.

Comparing proteins

The investigators prospectively identified 74 patients with aseptic or septic failure of arthroplasty components who were undergoing revision hip or knee arthroplasty at a single institution between February 2009 and May 2010. They collected synovial fluid specimens from each patient in the operating room at the time of revision surgery, prior to arthroscopy.

"Clinical and hospital records were reviewed for all patients to obtain information on patient characteristics, evaluations for infection, clinical presentation and outcomes, and surgical details," explained Dr. Parvizi.

Clinical and laboratory criteria were used to classify 31 samples as infected and 43 samples as uninfected. The researchers then analyzed the samples for the presence and concentration of 46 inflammatory proteins and conducted receiver operating characteristics curve analysis to identify proteins that could serve as accurate markers for PJI.

Measuring diagnostic capabilities

Dr. Parvizi noted that of the 46 proteins tested, 18 scored 0.70 or higher, indicating strong diagnostic capabilities, and five had values greater than 0.90, showing the greatest promise for use in diagnostic testing (Table 1).

The investigators found that C-reactive protein in the joint fluid had the highest combined sensitivity (97 percent), specificity (100 percent), and accuracy (99 percent) for diagnosis of PJI. "A limitation to our study includes the fact that we used a clinical diagnostic algorithm for differentiating between infected and uninfected cases," said Dr. Parvizi, noting the lack of standardized diagnostic criteria for PJI is partly due to significant reevaluation of the base assumptions related to PJI in recent years.

The future of PJI diagnosis

Dr. Parvizi identified the following findings as the most important:

- Inflammatory proteins can be detected in synovial fluid, and their concentrations can be ascertained.
- These varying concentrations align well with the presence or absence of PJI.

He noted that numerous other medical fields have had great success in the use of protein profile-based assays for fast, cost-effective, and easy diagnosis.

"For decades," he said, "the ability to isolate an organism from preoperative or intraoperative cultures on solid medium was considered the gold standard for diagnosis of infection. But today, surgeons are increasingly aware of the widely variable and frequently subtle etiology of PJI."

He added that "if a reliable, effective marker or set of markers for diagnosing PJI can be identified, a quick test for PJI may be on the horizon."

As part of the ongoing study, the researchers hope to confirm the diagnostic strength and thresholds for these proteins.

"Future studies will focus on designing assays with these proteins in mind to produce clinically useful diagnostic tests for PJI," Dr. Parvizi concluded.

Disclosure information—Dr. Parvizi's co-authors for “Molecular Markers for Diagnosis of Periprosthetic Joint Infection” are Christina Jacovides, BS; Bahar Adeli, BA; and Kwang Am Jung, MD.

Dr. Parvizi: Stryker, 3M, Musculoskeletal Transplant Foundation, Stryker Saunders/Mosby-Elsevier, SLACK Incorporated; Wolters Kluwer Health - Lippincott Williams & Wilkins; and Smarttech.

Ms. Jacovides, Ms. Adeli, and Dr. Jung report no conflicts.

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