

C-reactive protein levels for early detection of post-operative infection after fracture surgery in 787 patients

Sir—We read with interest the article by Neumaier and Scherer (2008) pertaining to the levels of C-reactive protein (CRP) in the diagnosis of early postoperative infection. The authors stressed C-CRP as the best marker for early infection.

We would like to discuss some of the conclusions of the article:

1. A cutoff in CRP of 98 mg/dL on day 4 would be highly suspicious but not conclusive, as a single reading has limited value. Rather, it is important to observe the trend, which is a steady increase. We believe that together with readings on day 2 and 4 postoperatively, a third reading at the end of the first week would add to the positive predictive value.

2. A CRP cutoff value of 98 mg/dL may not be optimal in all situations. The value depends on the type of surgery and the region being operated upon. More studies in this regard could help us to define optimal values.

3. The natural trend of CRP is to increase in the first 4–5 days, followed by a bimodal decline—a rapid decline after day 5 and a slow-phase decline by the third week.

4. To define a steady increase in CRP, we suggest: (1) A CRP value on day 4 that is > 80% of that on day 2; and (2) after day 4, CRP rising on 2 consecutive days with levels of > 15 g/mL on each day (positive diagnosis by day 6) (Tarik et al. 2002).

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Sir—Thank you for the letter from Drs Sunil Gurpur Kini and Phani Madhuri Vonnum concerning our article entitled “C-reactive protein levels for early detection of postoperative infection after fracture surgery in 787 patients” (Neumaier and Scherer 2008).

One of the objectives of the article was to establish the CRP levels after uncomplicated operative fracture treatment with different extents of surgical trauma. We therefore studied different extremity trauma regions. In all groups, the maximum CRP levels were reached on the second postoperative day. In some cases we found a maximum on the third postoperative day, but never later, when a normal postoperative course was seen. This is in accordance with almost all of the literature (Niskanen et al. 1996, Okafor and Maclellan 1998). Depending on the extent of operation, the decline to normal CRP levels takes 2–3 weeks.

In the phase of decline, a second rise indicates a complication; so we tried to establish the regular postoperative CRP for different trauma regions to obtain a single value for assessment of the course, whether or not there was infection. We found a cutoff for CRP levels of 98 mg/L any day after the fourth day following surgery. This CRP value is not a cutoff point on a fixed time axis after surgery. It depends on the time of onset of infection postoperatively. If the wound infection occurs on the ninth day, no value on day 2, 4, and 7 will show it (which is our answer to point 1).

We stated that 17 patients with deep infections do not provide good statistical power and further studies are necessary. Perhaps more CRP values postoperatively will give a better positive predictive value, but with the incidence of early deep wound infection of about 1%, it may not be justified; we do not monitor CRP levels every day. Also, the onset of early infection can occur anytime in the first few weeks. We measure CRP if there is any

clinical suspicion. In 16 of the 17 cases with deep wound infection, CRP was over 98 mg/L, independently of the trauma region or the maximum on the second postoperative day (which is our response to point 2).

If a CRP value after the fourth day is higher than 98 mg/L, we suspect infection—but we also use other diagnostic procedures and do revision surgery if necessary. CRP levels must always be correlated to the clinical situation, because every bacterial inflammation can cause high levels of C-reactive protein (e.g. pulmonary infection). No laboratory value alone can account for clinical decision making. Serial values are helpful to control the therapy.

The statement in point 4 regarding the overview article of Husani et al. (2002) was initially mentioned by Mustard et al. (1987), who investigated different kinds of surgery and septic complications (urinary tract infections, pneumonia). The sensitivity was 63% and the specificity was 82% with a CRP value on day 4 that was > 80% of that on day 2. After day 4, it rose on 2 consecutive days by > 15 g/mL. However, this schemata and is even more complex and with a low sensitivity.

Based on our findings, we believe that a cutoff level of about 100 mg/L after the fourth day (sensitivity 92%, specificity 93%) means that a trauma surgeon may detect deep wound infection early, with a better outcome for the patient.

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Sir—Neumaier and Scherer (2008) state that “no reliable data exists for CRP concentrations after uneventful operative fracture treatment.” However, we (Bourguignat et al. 1996, Jenny et al. 1999) reported the use of CRP (and transthyretin) to detect septic complications after open fracture of the lower limb. Actually, we found that a CRP level over 100 mg/L after 7 days was efficient for the diagnosis of infection, a result which is close to the results of Neumaier and Scherer.

Jean-Yves Jenny

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Sir—Thank you for the letter from Dr. Jean-Yves Jenny about our article “C-reactive protein levels for early detection of postoperative infection after fracture surgery in 787 patients.” The statement “no reliable data exist for CRP concentrations after uneventful operative fracture treatment” refers basically to the normal course after different fractures which we want to show in our article. There are some published data on special cases or including few patients. One of these is the respectable publication in 1996 from Bourguignat et al. investigating 80 patients with open fractures of the lower limb, with the aim of detecting infections with CRP. Here no differentiation of the fracture region (ankle or femur) was made, but CRP was found to be a good parameter for infection. The authors found a cut off level of 100 mg/L after 7 days which is close to our value.

We are sorry that we did not reference the work from Bourguignat et al.

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- Bourguignat A, Férard G, Jenny J Y, Gaudias J, Kempf I. Diagnostic value of C-reactive protein and transthyretin in bone infections of the lower limb. *Clin Chim Acta* 1996; 255 (1): 27-38.
- Husain T M, Kim D H. C-reactive protein and erythrocyte sedimentation rate in orthopaedics. *The University of Pennsylvania Orthopaedic J* 2002; 15: 13-6.
- Jenny J Y, Gaudias J, Bourguignat A, Férard G, Kempf I. C-reactive protein and transthyretin in early diagnosis of infection after open fractures of the lower limb (a preliminary study). *Rev Chir Orthop Reparatrice Appar Mot* 1999; 85 (4): 321-7.
- Mustard R A, Bohnen J M A, Haseeb S, et al. C-reactive protein levels predict postoperative septic complications. *Arch Surg* 1987; 122: 69-73.
- Neumaier M, Scherer M A. C-reactive protein levels for early detection of postoperative infection after fracture surgery in 787 patients. *Acta Orthop* 2008; 79 (3): 428-32.
- Niskanen R O, Korkala O, Pammo H. Serum C-reactive protein levels after total hip and knee arthroplasty. *J Bone Joint Surg (Br)* 1996; 78: 431-3.
- Okafor B, Maclellan G. Postoperative changes of erythrocyte sedimentation rate, plasma viscosity and C-reactive-protein levels after hip surgery. *Acta Orthop Belg* 1998; 64: 52-6.
- Tarik M, Husain D H, Kim C. Reactive protein and erythrocyte sedimentation rate in orthopaedics. *University Pennsylvania Orthop J* 2002; 15: 13-6.