Optimizing clinical treatment using DRG routine data - the PCT study

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Introduction
Clinical treatment of patients is often based on guidelines derived from randomized control trials (RCT). RCTs not necessarily reflect clinical routine reality. Therefore clinical routine data compromised in DRG datasets maybe a valuable source of information. In this study, procalcitonin (PCT) a biomarker that distinguishes between bacterial infections and other reasons for inflammation was examined using clinical routine data from DRG and PCT results from the lab. The objective was to determine whether guideline adherent use of PCT in the monitoring of antibiotic treatment strategies is useful and has a positive economic effect. If the antibiotic treatment is correct, PCT should fall to a normal value within 12 days. The endpoints were 'survival' and 'length of stay' (LOS) in survived patients.

Methods
We received DRG data in the German P21-format used for DRG analysis from 6 hospitals. On top of this the hospitals provided PCT lab results with date and value.

First we identified cases with 'Sepsis' as there is very good evidence that PCT is useful in the treatment of this disease. We did this by identifying the respective ICD-10 codes for Sepsis.

Next we added information to the dataset representing 'organ failure' an important prognostic parameter for sepsis.

Then we determined whether the use of PCT (identified by the series of measurements) was 'suitable' to enable good monitoring. We also identified the number of 'episodes' of pathological PCT values. If PCT was falling to clinically 'safe' value and was rising later again, we split this into episodes.

In the next step we built two groups of patients via applying a matching using a propensity score. The matching criteria were identified by a linear regression analysis.

All statistics were performed with IBM SPSS Version 19

Results
From 358,763 cases 3,854 had an ICD for 'sepsis'. Out of these patients 2,003 patient records showed at least one pathological PCT-test. Out of these 1,778 had one episode of sepsis (determined by the occurrence of pathological PCT results). 671 patients showed a suitable series of PCT-measurements to determine 'improvement'.

After matching we had 222 patients in the groups 'improvement' and 'no improvement'. From 222 patients 200 in the 'non-improvement group' died, while only 51 patients died in the 'improvement' group (p=0.000; chi-square test).

Although only a few patients survived in the 'no improvement group', we performed a t-test on the length-of-stay in the two groups. In the 'improvement group' LOS was 23.16 days and 33.59 days in the 'non-improvement' group (p=0.004; t-test for unbound samples).

Conclusions
Discussion
This analysis shows two major results. First of all routine data from DRG coding enhanced with lab data can be used for clinical and economical analyses. Second it clearly shows that a PCT-measurement that shows PCT going down to a 'safe' value is a highly significant predictor for survival.

As the number of patients from this fairly big sample is reduced with each step in the analysis, the question is why such a low number of patients receive guideline adherent PCT-testing (only 671 out of 1,778 patients). Moreover from these an even lower number showed 'improvement' (i.e. PCT going down). This can be due to two reasons: either doctors in ICU are not aware of the usefulness of measuring PCT to monitor their antibiotic therapy or they measure PCT but do not adjust their therapy even when PCT is staying in pathological areas.
As the number of surviving patients in the 'no improvement' group is much lower than in the 'improvement' group, we have to conclude that the advantages in LOS cannot fully be taken into account.

Conclusion

Using routine data for clinical analysis is possible and relatively inexpensive. Using PCT for monitoring the quality of antibiotic treatment and adjusting antibiotic regimens when PCT stays high has a significant advantage in survival.

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