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Measurement of eGFR before contrast-enhanced CT

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Background

The risk of Contrast Induced Nephropathy (CIN) increases with decrease in renal function. Measurement of renal function can be obtained by an estimated Glomerular Filtration Rate (eGFR). In patients with increased risk of impaired renal function, The European Society of Urogenital Radiology (ESUR) has recommended measurement of eGFR within 7 days before Contrast Enhanced Computed Tomography (CT).

In the absence of a valid eGFR, planned examinations using contrast-enhanced CT are postponed. Consequently, patients experience unforeseen delays and the radiological department suffers from inexpedient expenses due to prolonged procedures.

Aim

In the present study we aimed at evaluating if a quick on-site measurement of eGFR in patients at risk for CIN but without valid eGFR could reduce the expenses of the Radiological Department.

Method

Clinical data

We registered all patients who were referred to the Radiological Department, Herlev University Hospital for a non-acute contrast-enhanced CT examination during a one month period (July-August 2009). High-risk for CIN was assessed using ESUR guidelines, see Table 1 (www.esur.org/ESUR_Guidelines).

High risk for CIN:
- Dehydratio
- Congestive heart failure
- Gout
- Concurrent administration of nephrotoxic drugs

High risk for raised serum creatinine:
- Patients taking metformin
- Diabetes mellitus
- Renal disease
- Renal surgery
- Protenuria
- Hypertension

Table 1. ESUR Guidelines for high risk for CIN

From all high-risk patients without a valid serum creatinine, both s-creatinine and eGFR were obtained on-site by means of a point-of-care unit (POC) Stat Sensor®. These high-risk patients are denoted POC-patients (n=39). The eGFR was calculated by means of the Modification of Diet in Renal Disease (MDRD) formula (1). POC-patients with an eGFR >45mL/min/1.73m² underwent the planned contrast–enhanced CT examination. However, for diabetic patients in metformin treatment the threshold is an eGFR >60 ml/min/1.73m². The limits of eGFR >45mL/min/1.73m² and >60 ml/min/1.73m² is based on recent studies which conclude there is a low risk of CIN with eGFR >40 ml/min/1.73m² (2;3).

Figure 1. On-site eGRF measurement.

Ecomical data

We have performed a basic cost-benefit analysis based on estimated expenses of our radiological department. In Denmark all citizens have free access to medical aid. A CT examination is free of charge for the patient if the examination is subscribed by an authorized medical doctor. The price for a CT examination is determined by The Danish national board of health (Sundhedsstyrelsen) according to the Diagnosis-Related-Groups (DRG) and Dansk Ambulant Grupperingssystem (DAGS) rates (www.sst.dk).

References
1. Levey AS et al., 1999 *Ann Intern Med.*
2. Nyman U et al., 2005 *Acta Radiol.*
3. Thomsen HS and Morcos SK., 2009 *Eur Radiol.*

The DRG and DAGS are complex systems which rate the public Danish health services. The rate for a CT examination ranges from 187 Euro to 465 Euro. In this study, we have applied the average price for a CT examination (326 Euro). Other expenses related to the POC procedure are: StatSensor® (5.347 Euro), Test strip (6,70 Euro) (www.easymed.dk).

Once installed only few expenses are related to the POC unit. Minor expenses are kept out of this analysis.

Results

1126 patients were referred to a non-acute CT examination during the one month investigation period. After implementation of the POC measurement procedure, 39 examinations in patients at high risk for CIN were performed despite an invalid eGRF at referral. About 3 % of referred examination avoided being postponed. Cost-benefit analysis in table 2.

StatSensor	-5.347	
Test strips (39+30 *6,70)	-462	
DRG/DAGS rate(39*326)		+12.714
Total		**+6.905**

Table 2. Estimated expenses and revenues during a one month period. Amounts in Euro.

Conclusion

Applied to the Radiological department in Herlev Hospital the patient flow for CT examinations can be increased with approximately 3% by using a POC unit for on-site creatinine measurement. The expenses for the POC and test materials is readily covered after one month. Moreover, there are obvious clinical advantages for the patients. Finally, saving patients form re-referral on-site creatinine measurement also has potential socio-economic advantages.

This present study indicates that implementation of on-site creatinin measurement before contrast enhance CT may be advantagegeous in radiological departments subjected to public national health services similar to the Danish system.

Disclosure
The StatSensor and the test strips were provided free-of-charge by www.bracco.com to the Radiological Department at Herlev Hospital. The company was not otherwise involved in the present study.