breath-hold. Additionally, an inflow inversion recovery steady state free preces- 
sion sequence (Inhance) was used for non-contrast MR angiography (NCMRA).
Diameters of renal artery were assessed 20 mm from aortic ostium. Furthermore, the
aortic diameter was measured at height of renal artery orifice.

Results: 34 patients (66±8 years) were included in both conventional contrast
and non-contrast MR angiography and presented a total of 76 main and acces-
sory renal arteries. In CMRA mean renal artery diameter was 6.2±1.8 mm, in
NCMRA mean renal artery was determined with 6.0±2.0 mm. Mean diam-
eters were identified with 20.4±3.2 in CMRA and with 20.1±2.8 in NCMRA.
Measurements of renal artery by NCMRA closely correlate to renal artery diameters
assigned by CMRA (r=0.97). Furthermore, detection of aortic diameters showed
also good correlation between both MRA (r=0.92). Bland-Altman-analysis did not
present any signs of under- and overestimation of both measurement methods.

Conclusion: At 3T CMR determination of renal artery and aortic diameter at the
orifice of the renal arteries is possible by non-contrast MR angiography as well as
by 3D contrast MR angiography. Both methods provide reliable estimates of the
diameter of the vessel without relevant under- or overestimation. Non-contrast
MR angiography should be regarded as a powerful completely non-invasive tool
to image renal arteries without the need to use potentially nephrotoxic contrast
media.

P2944 | BEDSIDE
Sonographic position monitoring of central venous catheters by
microbubble-injection in real time: development of a new
procedure
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Background: Central venous catheter placement requires immediate confirma-
tion of its orthotopic position in the central vena cava to avoid arterial or paravasal
infusions which could potentially harm the patient. The correct position is usually
verified by chest x-ray or ECG. Echocardiography might offer a fast and safe alter-
avative. This study aimed at developing a new non-invasive, ultrasound-based pro-
cedure to determine the orthotopic position of Central Venous Catheters (CVC) by
sonographic detection of injected Microbubbles (MB).

Methods: With approval of the local ethics committee 95 patients with 98 CVC
and 5 peripheral catheters were examined. The appearance of MB in the right
heart can be observed after injection of agitated saline in the subcostal four-
chamber view. MB are hyperechogenic and dissolve later. The time from injec-
tion to the catheter to the appearance in the RV can be recorded by M-Mode
registration allowing an exact measurement independent of user interaction and
reaction. To determine positioning, time of appearance of MB was recorded. The
time was correlated with radiologically confirmed catheter positions. A self
assessment of the procedures practicability was performed on a linear analogue
scale (0-100%).

Results: We report a total of 95 Patients (65.6±18 years, 57% male). The jugu-
lar vein was used in 85 and the subclavian vein in 13 cases. The main diagnoses
requiring catheter placement were pneumonia (n=49), aortic valve reconstruction
(n=9), myocardial infarction (n=6), heart failure (n=6), gastrointestinal bleeding
(n=6) or others (n=9). In 95 patients with radiologically confirmed orthotopic posi-
tion MB appeared in the right heart in less than one second after injection with a
reliability of 99%. In 3 patients, quantitative measurement showed appearance of MB
was even below 0.5 seconds. In 5 patients with peripheral venous catheters MB were
observed later than 2 sec after injection and in one patient with a heterotopic CVC
appearance of MB was delayed. Duration of the procedure was 146 (111)
seconds (mean, (SD)). Physician's impression of practicalness was 91% (linear
analogue self assessment).

Conclusion: Ultrasound-based real-time position monitoring of CVC by this new
description of the MB-injection technique has the potential to serve as an alterna-
tive to X-ray or other methods. Appearance of MBs in less than one second can
be assumed to predict orthotopic position with high accuracy. Appearance of MB
in more than two seconds indicates malpositioning. Transit times between one
and two seconds require additional X-ray confirmation.

P2945 | BENCH
Accuracy of magnetic resonance for noninvasive cardiac output
quantification in postcapillary pulmonary hypertension

Purpose: Right ventricular (RV) failure is the main prognostic factor in pulmonary
hypertension (PH). Our aim was to evaluate the precision of different noninva-
sive approaches to calculate cardiac output (CO) by cardiac magnetic resonance
(CMR) in an experimental model of chronic postcapillary PH.

Methods: Postcapillary PH (N=13) was generated by banding of the inferior pul-
monary vein in piglets. Animals were followed for 4 months. Two animals died at 2
and 3 months due to severe PH. At baseline and every 4 weeks, animals underwent
RHC and immediate 3T CMR (N=62 pairs of measurements). CO was assessed by
RHC using a Swan-Ganz catheter (thermodilution method). CO was measured
by CMR in four different ways: 1) Phase-contrast (PC) on the pulmonary artery
(PA) as PA systolic volume*heart rate (HR); 2) PC on the aorta as aortic systolic
volume*HR; RV Symptom method as [RV end-diastolic volume – RV end-sistolic
volume]*HR; and 4) Left ventricular (LV) Symptom method as [LV end-diastolic
volume – LV end-sistolic volume]*HR. Accuracy was assessed using intraclass
correlation coefficient for absolute agreement and Bland-Altman analysis.

Results: Intraclass correlation coefficients for CMR measurements using RHC-
quantified CO as the gold standard were: 0.94 (% 95 CI 0.90-0.96) for PC on the
PA; 0.87 (% 95 CI 0.69-0.94) for PC on the aorta; 0.90 (% 95 CI 0.84-0.94) for RV Symptom method; and 0.89 (% 95 CI 0.82-0.93) for LV Symptom method.
According to Bland-Altman analysis, mean bias and limits of agreement were
respectively: -0.13 (-1.45,1.18); -0.47 (-2.02, 1.08); -0.20 (-1.80, 1.40); and -0.23
(-1.78, 1.31). Concordance between the different CMR methods was excellent
(Figure).

Conclusion: CMR accurately quantifies CO noninvasively in postcapillary PH.
Phase-contrast on the PA seems the best CMR method.