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Original article

# Diagnostic value of computed tomography for detecting anastomotic or staple line leakage after bariatric surgery

Marianne C. Kalff, M.D.[a,*], Christel A.L. de Raaff, M.D.[b], Claire E.E. de Vries, M.D.[a], Usha K. Coblijn, M.D.[c], Meta Tjeenk Willink, M.D.[d], Janneke M.B. Fauquenot-Nollen, M.D.[d], Sebastiaan Jensch, M.D., Ph.D.[d], Steve M.M. de Castro, M.D., Ph.D.[a], Ruben N. van Veen, M.D., Ph.D.[a]

[a] *Department of Surgery, OLVG, Amsterdam, the Netherlands*
[b] *Department of Surgery, ASZ, Dordrecht, the Netherlands*
[c] *Department of Surgery, VU Medical Center, Amsterdam, the Netherlands*
[d] *Department of Radiology, OLVG, Amsterdam, the Netherlands*

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**Abstract**

**Background:** Postbariatric anastomotic or staple line leakage (ASLL) is a dreaded complication with an incidence up to 1.6% and a leak-associated mortality of 5.0% to 16.7%. Feared low sensitivity of abdominal computed tomography (CT) for detecting ASLL is causing surgeons to omit CT and directly perform a diagnostic laparoscopy in patients with suspected ASLL.

**Objectives:** To evaluate the diagnostic value of CT in case of suspected ASLL after bariatric procedures and to identify reliable CT characteristics predicting the presence of ASLL.

**Setting:** A large teaching hospital and bariatric center of excellence.

**Methods:** All CT scans performed for suspected ASLL after bariatric surgery in the period November 2007 until August 2016 were independently reevaluated by abdominal radiologists. The diagnostic value of CT by means of sensitivity, specificity, and positive and negative predictive value was analyzed comparing results of reevaluation to a standard of reference. Multivariable regression was performed to identify reliable CT characteristics for the presence of ASLL.

**Results:** A total of 66 CT scans were performed because of suspected leakage. Reevaluation of CT scans revealed a sensitivity of 89% to 100%, a specificity of 69% to 78%, a positive predictive value of 39% to 50%, and a negative predictive value of 97% to 100% of CT for detecting ASLL after bariatric surgery. Multivariable logistic regression of ASLL characteristics on CT revealed 'air near the anastomosis/staple line' as the only independent predictor for the presence of ASLL.

**Conclusion:** With a sensitivity of 89% to 100% and negative predictive value of 97% to 100%, a negative CT can rule out ASLL in patients with a lower suspicion of ASLL. (Surg Obes Relat Dis 2018;000:1–7.) 

*Keywords:* Bariatric surgery; Anastomotic leakage; Staple line leakage; Computed tomography; Diagnostic laparoscopy

Postbariatric anastomotic or staple line leakage (ASLL) is a dreaded complication with an incidence up to 1.6% [1] and a leak-associated mortality of 5.0% to 16.7% [2–5]. ASLL is defined as the presence of intestinal fluid in the abdominal cavity caused by a defect in the anastomosis

*Correspondence: Marianne C. Kalff, M.D., Obesity Center Amsterdam, OLVG West, Jan Tooropstraat 164,1061 AE Amsterdam, the Netherlands.
E-mail addresses: m.c.kalff@olvg.nl, mariannekalff@hotmail.com (M.C. Kalff).

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or staple line [3]. Leakage after bariatric surgery mainly occurs within the first 24 to 72 hours after surgery [2–4]. Frequently observed but nonspecific signs and symptoms in cases of ASLL are abdominal pain, fever, tachycardia, leukocytosis, and increased fluid requirement [2–4,6–8]. Increasing body mass index, male sex, older age, multiple co-morbidities, previous abdominal surgery, and revisional procedures are factors associated with an increased risk of developing ASLL [3–5].

Abdominal computed tomography (CT) is often the diagnostic instrument of choice when leakage is suspected after bariatric surgery. However, only 3 studies have previously investigated the reliability of CT for detecting ASLL after bariatric surgery showing a wide range in sensitivity, with a lowest sensitivity of only 56% [2,4,7]. Therefore, in patients with a high suspicion of ASLL a diagnostic laparoscopy without primary CT is frequently chosen because of feared low sensitivity of CT.

The primary objective of this study was to determine the diagnostic value of CT in case of suspected ASLL after bariatric procedures. An additional objective was to identify reliable CT characteristics predicting the presence of ASLL.

## Methods

### *Study design and study population*

All consecutive patients who underwent a bariatric procedure containing an anastomosis or staple line in the period November 2007 until August 2016 were retrospectively reviewed. All patients were operated according to the International Federation for the Surgery of Obesity and Metabolic Disorders criteria for bariatric surgery [9]. The following surgical and revisional procedures were performed by experienced bariatric surgeons or by a resident under their direct supervision: laparoscopic Roux-en-Y gastric bypass, laparoscopic sleeve gastrectomy, one-anastomosis gastric bypass, and single-anastomosis duodeno-ileal bypass with sleeve gastrectomy.

CT scans performed within the reviewed population for suspected ASLL were selected for reevaluation. CT scans were independently reevaluated by 2 experienced abdominal radiologists and 1 abdominal radiology resident; all were blinded for the original CT reports. A checklist was used for reevaluation consisting of the following 6 criteria concerning ASLL: fluid, air and/or abscess near the staple line/anastomosis, extraluminal contrast, and fluid and/or air intra-abdominal (Appendix 1). CT scans were anonymized and subsequently reviewed in 2 phases. In the first phase, radiologists were blinded for all clinical information, except for the type of surgery and the number of postoperative days. Second-phase reevaluation followed directly after the first evaluation for every separate CT scan during the same session. In the second phase, radiologists received information about the clinical condition of the patient (e.g., the presence of abdominal pain, tachycardia, tachypnea, leukocytosis, and the level of C-reactive protein) to mimic normal daily routine. Both phases of evaluation were followed by a dichotomous conclusion for a final verdict about whether or not ASLL was present.

To enable correction for possible difficulties in reevaluation, the quality of performed CT scan was registered. Quality-related points of interest were the presence of intravenous and oral contrast and the existence of disturbing artifacts, such as respiratory or metal artifacts.

ASLL was diagnosed according to $\geq$1of the following criteria: dehiscence of the anastomosis or staple line visualized during diagnostic laparoscopy; passage of methylene blue through the gastrojejunostomy, staple line, or intra-abdominal drain after oral administration; and/or the presence of an intra-abdominal abscess on CT in close relation to the anastomosis or staple line for which surgical or radiologic intervention was performed.

With this definition of ASLL, a standard of reference was computed. The positive standard of reference was ASLL visualized on CT or during laparoscopy for which radiologic or surgical intervention was performed. The negative standard of reference was propitious clinical recovery without radiologic or surgical intervention after a negative CT or diagnostic laparoscopy.

The diagnostic value of CT by means of sensitivity, specificity, and positive and negative predictive value (PPV and NPV) was analyzed by comparing results of reevaluation to the standard of reference. Follow-up after a negative result was at least 30 days.

A sensitivity analysis was performed to determine whether the diagnostic value of CT differs between patients without co-existence of tachycardia and tachypnea and patients with co-existence of tachycardia and tachypnea at the moment of suspicion.

### *Characteristics computed tomography*

For CT scans performed before December 2011, the Toshiba Aquilion 4-slice scanner was used. Since December 2011, the GE discovery 64-slice scanner was used. CT scans were performed with oral and intravenous contrast; exception was made for patients with contrast allergy.

### *Data collection and statistical analysis*

Baseline characteristics were obtained from patients' records. Based on the standard of reference patients were divided into a leakage and a nonleakage group. Continuous data were compared using independent $t$ test and Mann-Whitney $U$ test, and outcomes were shown as mean $\pm$ standard deviation and median with interquartile range, respectively. Categoric data were compared using $\chi^2$ analysis and shown as number of patients (%).

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