Evaluation of the value of abdominopelvic acquisition without contrast injection when performing a whole body CT scan in a patient who may have multiple trauma

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Abstract

Purpose: To evaluate the diagnostic value of non-contrast-enhanced abdominopelvic acquisition when performing a whole body CT scan in a patient who may have multiple trauma.

Patients and methods: In a single centre, retrospective study over 1 year, we included 84 patients suspected of having multiple trauma who indeed presented an abdominal or pelvic lesion during the initial CT scan. Two readers independently reread the acquisitions without injection, then those with injection, then all the acquisitions, and scored the presence or absence of abdominopelvic lesions. Statistical analysis focused on intra- and inter-observer agreement, and on the sensitivity and specificity of the different acquisitions in relation to consensus rereading.

Results: This study did not reveal any significant difference, particularly concerning improvement in sensitivity, between interpretation of the acquisitions with contrast injection and interpretation of all the acquisitions with or without injection. Inter-observer agreement was substantial to almost perfect. Non-contrast-enhanced thoraco-abdominopelvic acquisition represented 20% to 25% of the effective dose for the entire examination.

Conclusion: Abdominopelvic acquisition without contrast injection in addition to acquisition with contrast injection in a patient suspected of having multiple trauma does not improve detection of traumatic lesions of the liver, spleen, kidneys or adrenal glands, nor of intra- or retroperitoneal effusion, but increases the dose and should be abandoned.

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A whole body CT scan has become the essential element in initial examination of a patient with suspected multiple trauma and for checking stable or stabilised haemodynamics [1,2].

Performed early on, this examination provides an exhaustive report of lesions and reduces mortality in multiple trauma patients [3]. CT scanning protocols vary according to the material available, the team’s habits and consideration of the X-ray dose delivered to the patient (although this is secondary where the patient’s state is critical). In particular, non-contrast-enhanced abdominopelvic acquisition is debated.

The literature suggests a number of protocols: most teams do not perform non-contrast-enhanced thoracic or abdominal acquisition [1,4–11], while others do undertake thoraco-abdominopelvic [12] or abdominal [13–15] acquisition without contrast injection. This type of acquisition in the abdominal region is thought to be important for looking for spontaneous hyperdensity resulting from the presence of blood [13–15]. In particular, it is considered of assistance in detecting small, particularly mesenteric haematomas, haemoperitoneum and hepatic, splenic or renal haematomas. These lesions are hyperdense before injection but are considered more difficult to detect after injection because of poorer contrast with the organs enhanced (Figs. 1 and 2) [14]. Some teams undertake oral opacification [6,16], while others suggest only making acquisitions centred on the region where trauma is suspected [12] but this attitude is controversial [17].

The recommendations of the Société Française de Radiologie (French Radiology Society) [18] for performing a CT scan in a patient with multiple trauma are: non-contrast-enhanced acquisition of the brain and neck, possibly non-contrast-enhanced thoraco-abdominopelvic acquisition followed by thoraco-abdominopelvic acquisition (possibly extending to the neck and legs) in the arterial phase (20

![Figure 1](image1.png)  
**Figure 1.** Mesenteric haemorrhagic contusion (white arrow) hyperdense with no contrast agent, showing a lesser degree of contrast with the organs enhanced after injection: a: non-contrast-enhanced acquisition; b: acquisition after contrast injection in the portal phase.

![Figure 2](image2.png)  
**Figure 2.** Fracture of the left kidney with perirenal hyperdense haematoma with no injection of contrast agent (white arrows), appearing hypodense after contrast injection but which can be characterised due to its density of 52 HU even with contrast-enhanced acquisition: a: non-contrast-enhanced acquisition; b: acquisition after contrast injection in the portal phase.
to 30 s after starting the injection) then abdominopelvic acquisition in the portal phase (70 to 90 s after the start of the injection) and finally, possibly, where there are renal or perirenal anomalies or if there is any doubt about damage to the bladder, abdominopelvic acquisition in the late phase (5 minutes).

In contrast, in its recommendations of June 2011 [19], the British Royal College of Radiologists considers that non-contrast-enhanced thoraco-abdominopelvic acquisition is of no interest in a traumatic context.

In our establishment, non-contrast-enhanced thoraco-abdominopelvic acquisition is systematically performed in patients suspected of having multiple trauma.

The aim of our study is to evaluate the diagnostic usefulness of this acquisition when performing a whole body CT scan in a potentially multi-trauma patient.

Patients and methods
Population studied

For this single centre, retrospective study, we searched our establishment’s PACS for patients who had had an emergency whole body CT scan in the period between 01/01/2010 and 31/12/2010.

This identified 282 patients who had had such a CT scan for suspected multiple trauma. We reread all the reports on these patients and included the 88 patients who had at least one abdominopelvic traumatic lesion. Four patients were excluded because their examination protocol was incomplete: one for whom the non-contrast-enhanced thoraco-abdominopelvic acquisition was missing, three for whom there had been no injection of an iodinated contrast agent (one presenting a compressive acute subdural haematoma had required immediate neurosurgical treatment, one had a history of allergy to iodinated contrast agents and an 84-year-old patient had severe renal impairment).

The only imaging examinations conducted prior to the whole body CT scan were frontal X-rays of the thorax in the resuscitation room, together with an ultrasound examination, in haemodynamically unstable patients, to detect peritoneal, pericardial and pleural effusion.

Technique for performing the CT scan

All the examinations were performed in 64 × 0.5 mm helical mode, 73 of them using a 320-row detector Aquilion One scanner (Toshiba Medical Systems, Tokyo, Japan) and 11 with a 64-row detector Aquilion 64 scanner (Toshiba Medical Systems, Tokyo, Japan).

The protocol included producing non-contrast-enhanced cervico-encephalic and thoraco-abdominopelvic acquisitions. After injection of 140 mL of contrast agent (iomeprol at 400 mg of iodine/mL, Bracco Altana Pharma, Constance, Germany), acquisition was undertaken in the arterial phase extending from the base of the skull to the toes, followed by abdominopelvic acquisition in the portal phase. Finally, if necessary, the resident or senior doctor present at the console decided whether to undertake a late abdominopelvic acquisition.

The operators produced reformation of the various volumes in the three spatial planes as well as reformation of the spine and aorta, then volume rendering reformation of the thoracic cage, the face and bone lesions.

The resident and senior doctor analysed the results together on the PACS consoles (IMPAX V5, AGFA HealthCare), or this was done first by the resident and then validated by the senior doctor.

Reading the CT scans

In separate sessions at an interval of several days, reader 1 (4th year resident) and reader 2 (senior doctor, registrar in the department) independently reread only the non-contrast injection abdominopelvic acquisitions then only the abdominopelvic acquisitions with injection, and in a third reading, all the abdominopelvic acquisitions with and without contrast agent injection. The two readers then produced a consensus rereading based on the results of all these readings, the examination report recorded in the PACS, the control scans and, for the 12 patients who had abdominal or pelvic surgery, the operation reports.

For each series, they listed the presence or absence of traumatic lesions of the liver, spleen or kidneys, of adrenal haematomas, of haemorrhagic intestinal-mesenteric lesions, of liquid peritoneal and retroperitoneal effusion.

The definitions used were those described in the paper by C. Ridereau-Zins et al. [14].

All lesions were considered as being present whatever their size, severity and clinical significance. In particular, the presence of a traumatic lesion of the liver, spleen and kidneys was noted whenever there was a haematoma, contusion, laceration or fracture. The intestinal-mesenteric lesions noted were oedematous damage, haematomas and mesenteric haemorrhage, as well as digestive ischaemia secondary to these lesions and haematomas of the walls of the digestive tube. Peritoneal and retroperitoneal effusions were listed whatever their spontaneous density and abundance.

Statistical analysis

The study population was subjected to a descriptive analysis. The qualitative variables are shown as percentages and the quantitative variables are means with standard deviation.

Cohen’s kappa coefficients, their standard error and the adjusted kappa coefficients (PABAK) were calculated for each lesion, comparing the results of non-contrast-enhanced acquisition, acquisition with injection and all acquisitions with and without injection, in order to estimate intra- and inter-observer agreement. Contingency tables were generated from the analyses performed.

To situate the kappa and PABAK coefficients obtained from our sample, we used the classification proposed by Landis and Koch: no agreement for negative values, slight from 0.0 to 0.20, fair from 0.21 to 0.40, moderate from 0.41 to 0.60, substantial from 0.61 to 0.80, almost perfect from 0.81 to 1 [20–23].
The sensitivity and specificity of each acquisition and the reports recorded in the PACS were calculated relative to the consensus rereading.

Data were entered using the Excel 2010 program from Microsoft Corporation (Redmond, Washington, USA) and the statistical analysis used SAS® 9.2. (SAS Int. Inc., Cary, NC, USA).

The statistical analysis was performed and the results interpreted and presented with the help of an epidemiologist from our establishment’s Clinical Epidemiology Department.

## Dosimetry

To study the additional dose of radiation delivered to the patient during non-contrast-enhanced thoraco-abdominopelvic acquisition, we analysed the dosimetric reports of the 73 examinations performed with the Aquilion One scanner. With the dosimetric reports of the 11 examinations performed with the Aquilion 64 scanner, the dose-length product (DLP) for non-contrast-enhanced acquisitions could not be separated from the DLP for the acquisitions with injection.

We calculated the mean and standard deviation of the DLPs, expressed in mGy.cm, for the non-contrast-enhanced thoraco-abdominopelvic acquisitions and for the thoraco-abdominopelvic and lower limb acquisitions with contrast injection. (The DLP of lower limb acquisition in the arterial phase could not be separated from that of thoraco-abdominopelvic acquisition performed in the same helix).

The effective dose (E) expressed in millisievert (mSv) was then estimated, with the formula E = DLP × k, using a tissue conversion coefficient (k) of 18 μSv/mGy cm [24].

## Results

The population studied consisted of 65 men (77%) and 19 women (23%) with a mean age of 38.8 years (standard deviation of 17.8).

The prevalence of the various lesions is summarised in Table 1.

Using the adjusted kappa (PABAK), intra-observer agreement between reading the acquisitions with injection and reading all the acquisitions varied depending on the lesions. For reader 1, it was substantial to almost perfect (PABAK varying from 0.67 to 0.91). The agreement for reader 2 was also substantial to almost perfect (PABAK varying from 0.79 to 0.91) (Table 2).

Inter-observer agreement was substantial to almost perfect for all the lesions for reading the acquisitions with and without injection and for reading all the examinations, with the exception of moderate agreement for peritoneal effusion (Table 2).

### Table 1 Prevalence of lesions depending on the reader and acquisitions.

<table>
<thead>
<tr>
<th>Organs</th>
<th>Reader 1</th>
<th>Reader 2</th>
<th>Consensus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NI</td>
<td>INJ</td>
<td>NI + INJ</td>
</tr>
<tr>
<td>Adrenal haematoma</td>
<td>7 (8.3)</td>
<td>12 (14.3)</td>
<td>13 (15.5)</td>
</tr>
<tr>
<td>Liver lesion</td>
<td>2 (2.4)</td>
<td>22 (26.2)</td>
<td>22 (26.2)</td>
</tr>
<tr>
<td>Spleen lesion</td>
<td>5 (6)</td>
<td>24 (28.6)</td>
<td>23 (27.4)</td>
</tr>
<tr>
<td>Kidney lesion</td>
<td>5 (6)</td>
<td>12 (14.3)</td>
<td>10 (11.9)</td>
</tr>
<tr>
<td>Intestinal-mesenteric lesion</td>
<td>5 (6)</td>
<td>7 (8.3)</td>
<td>9 (10.7)</td>
</tr>
<tr>
<td>Peritoneal effusion</td>
<td>34 (40.5)</td>
<td>55 (65.5)</td>
<td>55 (65.5)</td>
</tr>
<tr>
<td>Retroperitoneal effusion</td>
<td>28 (33.3)</td>
<td>31 (36.9)</td>
<td>41 (48.8)</td>
</tr>
</tbody>
</table>

Number of cases (%).
NI: acquisition without contrast injection; INJ: acquisition with contrast injection; NI + INJ: all acquisitions; Consensus: consensus rereading.

### Table 2 Intra-observer agreement (acquisitions with contrast injection vs. all acquisitions).

<table>
<thead>
<tr>
<th>Organs</th>
<th>Reader 1</th>
<th>Reader 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K (SE)</td>
<td>95% CI</td>
</tr>
<tr>
<td>Adrenal haematoma</td>
<td>0.67 (0.11)</td>
<td>0.45–0.89</td>
</tr>
<tr>
<td>Liver lesion</td>
<td>0.88 (0.06)</td>
<td>0.76–0.99</td>
</tr>
<tr>
<td>Spleen lesion</td>
<td>0.85 (0.06)</td>
<td>0.73–0.98</td>
</tr>
<tr>
<td>Kidney lesion</td>
<td>0.79 (0.10)</td>
<td>0.59–0.99</td>
</tr>
<tr>
<td>Intestinal-mesenteric lesion</td>
<td>0.44 (0.16)</td>
<td>0.13–0.77</td>
</tr>
<tr>
<td>Peritoneal effusion</td>
<td>0.89 (0.05)</td>
<td>0.79–0.99</td>
</tr>
<tr>
<td>Retroperitoneal effusion</td>
<td>0.67 (0.08)</td>
<td>0.51–0.82</td>
</tr>
</tbody>
</table>

K: Kappa; SE: Standard error; CI: confidence interval.
effusion when interpreting non-contrast-enhanced acquisitions (PABAK = 0.48) (Table 3).

There was no improvement in sensitivity between reading acquisitions with injection and reading all the acquisitions with and without injection, except in the case of retroperitoneal effusion by reader 1.

Sensitivity in detecting liver and spleen lesions was significantly improved through interpreting the acquisitions with contrast injection compared with just the non-injection acquisitions. A similar tendency was found for kidney lesions, adrenal haematomas and peritoneal effusions.

Sensitivity in detecting mesenteric lesions and retroperitoneal effusion did not seem to be improved by reading either the acquisitions with or without injection (Table 4).

Specificity was excellent for the two readers and all the acquisitions.

Considering intestinal-mesenteric haemorrhagic lesions more particularly, only two patients had an emergency operation, one for a haematoma of the greater omentum with active haemorrhage, the other for a wound to a branch of the mesenteric artery caused by a penetrating trauma (metal bar transfixing the pelvis, abdomen and thorax, in position when the CT scan was performed). Three other patients underwent surgery for suspected perforation of the digestive tube: the first indeed presented perforation of the small intestine, the second perforation of the bladder (false-positive), while for the third no perforation was found, although he had a pneumoperitoneum. The other intestinal-mesenteric lesions were mesenteric haemorrhagic contusions (5 cases) or small haematomas (2 cases) which did not require surgery and diagnosis of which could not be confirmed.

In our series, the DLP for non-contrast-enhanced thoraco-abdominopelvic acquisition was a mean of 1499 mGy.cm (standard deviation: 482), i.e. 24% of that of all the thoraco-abdominopelvic and lower limb acquisitions, which was 6256 mGy.cm (standard deviation: 1953). The mean of the effective dose for acquisition without contrast injection was approximately 27 mSv.

Discussion

In our study, intra-observer agreement between the acquisitions with injection and all the acquisitions was substantial to almost perfect. In addition, the sensitivity of acquisitions with injection was not improved by interpreting acquisitions without injection at the same time.

There is therefore no advantage to performing non-contrast-enhanced acquisition in addition to acquisition with contrast injection in patients with one or more abdominopelvic traumatic lesions.

This corresponds with the recommendations [19] and the practice of very many teams who do not undertake non-contrast-enhanced abdominopelvic or thoraco-abdominopelvic acquisitions in patients with suspected multiple trauma [1,4–11].

In 1988, Kelly J. et al. [13] showed the usefulness of non-contrast-enhanced abdominal acquisition in addition to contrast-enhanced acquisition for abdominal trauma. In their study, the sensitivity and specificity of all the examinations were improved from 74 to 92% and from 84 to 91% respectively, by acquiring 10 slices of 10 mm spaced at 20 mm without contrast injection on the upper part of the abdomen.

In 1992, a study by Miyakawa K. et al. [25] confirmed these results in 126 patients. Non-contrast-enhanced acquisition helped in particular to diagnose the 12 traumatic intestinal lesions requiring emergency surgical management, whereas with acquisition with contrast injection only 10 were diagnosed.

Since these old studies, however, CT technology and image quality have considerably improved. Volume acquisitions are nowadays interpreted on PACS consoles with multiplanar reformations.

Our study’s inter-observer agreement is clearly much higher than in the study by Agostini et al. [11] on the usefulness of dual reading of whole body CT scans in the management of multiple trauma patients, which found an inter-observer kappa of 0.41 (95% confidence interval of 0.35

<table>
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<th>Table 3</th>
<th>Inter-observer agreement.</th>
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<tr>
<td>Organs</td>
<td>Acquisitions without injection</td>
</tr>
<tr>
<td></td>
<td>K (SE)</td>
</tr>
<tr>
<td>Adrenal haematoma</td>
<td>0.59 (0.15)</td>
</tr>
<tr>
<td>Liver lesion</td>
<td>0.66 (0.23)</td>
</tr>
<tr>
<td>Spleen lesion</td>
<td>0.75 (0.14)</td>
</tr>
<tr>
<td>Kidney lesion</td>
<td>0.90 (0.09)</td>
</tr>
<tr>
<td>Intestinal-mesenteric lesion</td>
<td>0.23 (0.13)</td>
</tr>
<tr>
<td>Peritoneal effusion</td>
<td>0.49 (0.09)</td>
</tr>
<tr>
<td>Retroperitoneal effusion</td>
<td>0.75 (0.08)</td>
</tr>
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</table>

K: Kappa; SE: Standard error; CI: confidence interval.
to 0.46) for all the lesions of a whole body CT scan. That can be explained by our studying the agreement lesion by lesion, and only being concerned with the abdomen. We also used the PABAK, which sometimes differs from kappa.

On the other hand, in the study by Yu J. et al. [16] on isolated small peritoneal effusions, the kappa coefficient for this single sign between two observers was 0.76, which gives a result close to the inter-observer kappa that we found for free peritoneal effusions (kappa = 0.85 for the acquisitions with injection and 0.74 for all acquisitions).

An important limitation of our study was taking into account all the lesions visible on the CT scan whatever their size and clinical impact. Many of these lesions were of no or little consequence (e.g. simple contusions or small subcapsular haematomas of solid organs, adrenal haematomas and small peritoneal or retroperitoneal effusions) and only required monitoring. A false-positive or false-negative for these lesions had no impact on management of the patient.

Conversely, serious haemorrhagic lesions are life-threatening and require immediate surgery and intensive care. When they concern the liver, spleen or kidneys, their diagnosis poses no problem from just contrast-enhanced acquisitions.

On the other hand, mesenteric and intestinal trauma is rare, particularly serious and more difficult to diagnose. Its early diagnosis depends almost exclusively on the

<table>
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<th>Table 4</th>
<th>Sensitivity and specificity of lesions depending on the reader and acquisitions.</th>
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<tr>
<td></td>
<td>Reader 1</td>
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<tr>
<td></td>
<td>NI</td>
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<tr>
<td>Adrenal haematoma</td>
<td>Sensitivity</td>
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<td></td>
<td>Specificity</td>
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<tr>
<td>Liver lesion</td>
<td>Sensitivity</td>
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<td>Spleen lesion</td>
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<td>Kidney lesion</td>
<td>Sensitivity</td>
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<td>Intestinal-mesenteric lesion</td>
<td>Sensitivity</td>
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<td></td>
<td>Specificity</td>
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<td>Peritoneal effusion</td>
<td>Sensitivity</td>
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<td></td>
<td>Specificity</td>
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<tr>
<td>Retroperitoneal effusion</td>
<td>Sensitivity</td>
</tr>
<tr>
<td></td>
<td>Specificity</td>
</tr>
</tbody>
</table>

NI: acquisition without contrast injection; INJ: acquisition with contrast injection; NI + INJ: all acquisitions.
Value (standard error) [95% confidence interval].
abdominal CT scan because clinical signs and symptoms are non-specific. A false-negative can result in delayed diagnosis responsible for increased morbidity and mortality due to haemorrhage, sepsis and peritonitis [6,26–29].

A limitation of our study was that it included only very few lesions of this type that had required surgical treatment (one mesenteric haematoma with active bleeding; one haemorrhage due to a penetrating trauma — but detection of this lesion posed no problem since the object causing the injury was still in situ; two bowel perforations, one of which was not found by surgery; and a false-positive for bladder perforation). The seven other lesions only required monitoring.

It could be useful to conduct an additional study focusing solely on traumatic intestinal-mesenteric lesions that have required surgical management. This additional study would help overcome the limitations of our work for these rare but serious lesions that are difficult to diagnose.

There could be two disadvantages to undertaking non-contrast-enhanced thoraco-abdominopelvic or abdominopelvic acquisition during a whole body CT scan in a patient suspected of having multiple trauma: the time taken and the irradiation.

The time for acquisition is less than 10s, even counting the time for programming it, moving the table, etc. The increase in time for the patient in the CT scan room is 1 to 2 min. Positioning the patient and the topograms are the same as for the contrast-enhanced acquisitions and therefore do not lengthen the protocol. Reconstructions are done during the preparation for and while carrying out the contrast-enhanced acquisitions and do not increase the length of the examination. The time taken to perform this acquisition is therefore negligible compared with the patient’s total stay in the CT scan room, which is about 30 min.

Our evaluation of the effective dose is not very precise and has numerous biases: the DLP not taking into account either the length of exploration or the patient’s morphotype, the DLP of acquisition in the arterial phase including the legs, and use of a single tissue conversion coefficient (k).

Since performing our study, the protocol has been optimised, while retaining all the acquisitions, with considerable reduction in the exposure parameters and the use of iterative reconstruction algorithms. We therefore studied the dosimetry of the first 20 patients for the month of January 2012 who were scanned using the Aquilion One scanner with a whole body protocol for suspected multiple trauma.

During these examinations, the mean DLP for non-contrast-enhanced thoraco-abdominopelvic acquisition was 449 mGy.cm (standard deviation: 136), i.e. 20% of the DLP of all the thoraco-abdominopelvic and lower limb acquisitions, which was 2282 mGy.cm (standard deviation: 799). On average, the effective dose for non-contrast-enhanced acquisition was about 8 mSv but represented a little more than 20% of the total effective dose. Indeed, the total effective dose is slightly overstated due to the use of a global tissue conversion factor without separating thoraco-abdominopelvic acquisition in the arterial phase from acquisition of the lower limbs. However, the tissue conversion factor for the lower limbs is much lower than the global tissue conversion factor used.

Since optimisation of the protocol and the use of iterative reconstruction, the DLP and therefore the effective dose, which is proportional to the DLP, have been reduced by about 70% for non-contrast-enhanced thoraco-abdominopelvic acquisition and by about 64% for the entire protocol.

Since these modifications, the additional dose of radiation (8 mSv) due to non-contrast-enhanced thoraco-abdominopelvic acquisition performed at low dose and read in semi-thin slices has been very significantly reduced compared with the former protocol (27 mSv), but it still represents about 20% of the dose of the whole protocol and eliminating it would mean a further dose reduction.

The limitations of our study are due to its retrospective and single centre character and, as we saw earlier, to analysis of all lesions without consideration for either their severity or their therapeutic impact. However, even frequent diagnostic errors on lesions without clinical consequences are less serious than a single error which is life-threatening.

Moreover, even when taking into account operation reports and clinical evolution, consensus rereading is a source for discussion, particularly concerning the presence or absence of minimal lesions which have no therapeutic impact, but may have a statistical impact by modifying the sensitivity and specificity of the different readings. During consensus rereading, a minor lesion was recorded if it had been found by one reader on one acquisition but missed by the other reader or on other acquisitions. This explains a low number of false-positives and thus the excellent specificity of all the acquisitions. To limit these biases, it would have ideally been best to list the severity of the different lesions.

Finally, our study was limited to abdominopelvic lesions to the exclusion of studying thoracic lesions. This choice was made because among the 282 patients suspected of having multiple trauma and who underwent a whole body CT scan, only four presented rupture or dissection of the aortic isthmus necessitating treatment and two presented doubtful untreated lesions which remained stable on the control scans. Moreover, only one presented a haemopericardium. The total number was considered too small to be studied. In addition, the presence of a mediastinal haematoma, detection of which could possibly be improved by non-contrast-enhanced acquisition, shows few specific differences from a large vessel lesion [1].

Conclusion
The disadvantages of performing non-contrast-enhanced abdominopelvic acquisition in addition to acquisition with contrast injection in a patient suspected of having multiple trauma are loss of time, which is minimal, but an increase in dose of about 20 to 25%. It does not improve detection of traumatic lesions of the liver, spleen, kidneys or adrenal glands, nor of intra- or retroperitoneal effusion, and should be abandoned.

Disclosure of interest
The authors declare that they have no conflicts of interest concerning this article.
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