



PHILIPS

SkyFlow

Diagnostic X-ray

Hospital Sant Pau finds image quality fully diagnostic with SkyFlow **at low dose settings**

Who
Hospital de Santa
Creu i Sant Pau

Where
Barcelona,
Spain

Bedside chest radiographs are the most frequent radiological tests performed in the intensive care unit (ICU).^{1,2} In particular, patients with acute cardiopulmonary problems or those on mechanical ventilation may receive daily chest X-ray exams while in the ICU. This adds up to a significant cumulated dose for these ICU patients.

To investigate the image diagnostic quality of Philips SkyFlow for portable chest radiographs in the ICU at low dose settings, Hospital Sant Pau conducted a visual grading study. SkyFlow images at low dose settings were excellent when compared to images without SkyFlow acquired at normal dose settings.* The results have had an immediate impact on the settings used in the daily practice in the ICU at Hospital Sant Pau.

* Results from case studies are not predictive of results in other cases. Results in other cases may vary.



A visual grading study compared images at two dose levels

To determine the impact of SkyFlow, the hospital conducted a study with 50 patients who received clinically indicated chest X-rays on two consecutive days. The first day's images were acquired using a reference protocol of 80 kV, without a grid.

On the second day, the patient received an exposure at low dose settings. The images were processed both with and without SkyFlow, and were then blind-rated by two expert radiologists, who graded the images on a scale of 1 to 10.

"Readers rated each image with both a general score and on the visibility of six anatomical features," Dr. Capdevila explains. "We then averaged the scores of the readers per feature and used an analysis of variance (ANOVA) to assess the influence of dose and SkyFlow on image quality."

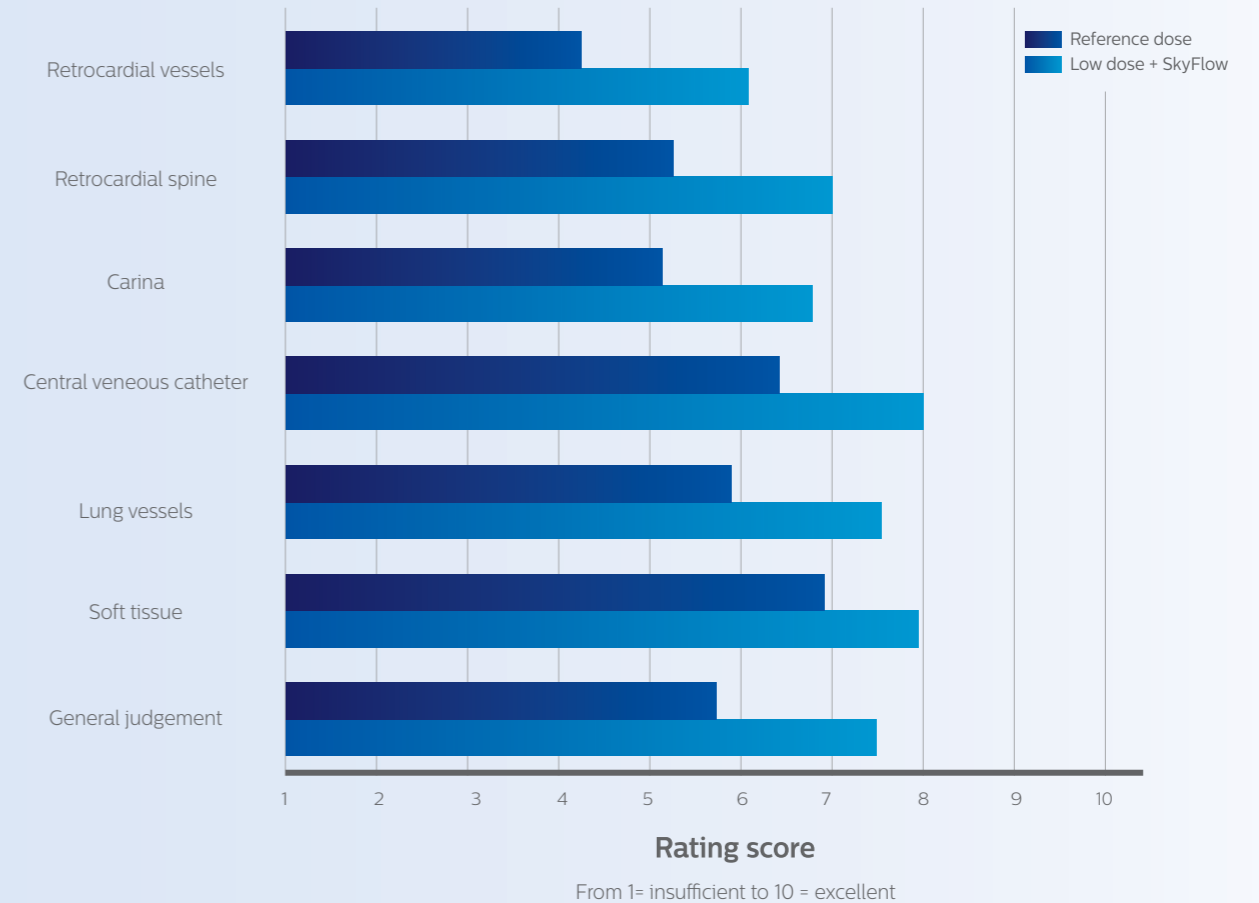
Result: Higher image quality with SkyFlow at low dose settings*

The ANOVA tests showed that the scores of images processed with SkyFlow were higher than those processed without it for each feature, as well as for the general score. Even the images obtained at low dose settings using SkyFlow were scored higher than standard protocol images without SkyFlow (see Figure 1).

"The scores of the low dose images with SkyFlow were adequate when compared to reference dose images without SkyFlow. This result gives us confidence that we can use SkyFlow to achieve good image quality at low dose settings" Dr. Ribas concludes. "These convincing results have had immediate impact on our routine dose settings," she adds. "We are now using low dose settings in our standard chest protocol."

Figure 1.

Graph of image ratings with grading scale



“We want to use as low a dose as possible, and yet we need high image quality.”

Antoni Capdevila, leading the Diagnostic Imaging Department

Low dose settings for ICU patients with adequate image quality

At Hospital de Santa Creu I Sant Pau (Barcelona, Spain), the most frequent indication for chest X-ray exams is to verify correct positioning of tubes and lines.

Antoni Capdevila, leading the Diagnostic Imaging Department, explains that frequency of chest X-rays in the ICU necessitates extra vigilance about patient dose. "While the dose of a single chest X-ray is low, patients who are in the ICU for an extended time, or who are admitted several times, accumulate more dose," he says. "We want to use as low a dose as possible, and yet we need high image quality."

He notes that the Hospital Sant Pau ICU does not use anti-scatter grids to improve image quality, because there is a trade-off with dose and that the use of them is not handy. "An additional problem with grids is that exact positioning is very challenging with ICU patients, and severe grid cut-off may result in loss of useful radiation and even retakes," he says. "In the past, we had to accept that the contrast of the grid-less images is poor due to scattered radiation. However, when we introduced Philips SkyPlate detectors and SkyFlow, we saw adequacy in image quality that we wanted to investigate at low dose settings."

Modern flat-panel detectors provide opportunity to manage dose setting

"We immediately realized that our CR settings were too high for our new DR systems," says Dr. Monserrat Ribas, leading the Medical Physics department. "We wanted to take full advantage of the dose management potential of DR detectors without compromising image quality, and we managed dose accordingly."

In addition, radiologists at Hospital Sant Pau noticed that SkyFlow scatter correction technology provided adequate image quality. "Even after utilizing low dose settings, we saw adequate image quality with SkyFlow when compared to images without SkyFlow,"



Photograph by Lluís Casals

Without SkyFlow



With Skyflow



How SkyFlow works

For use in both bedside and trolley chest exams, SkyFlow technology identifies scatter signal and automatically subtracts it from the image, resulting in grid-like image contrast.³

To deliver the correct contrast automatically for each individual patient type - from pediatric to bariatric, SkyFlow first estimates the scatter based on pre-calculated scatter patterns that originate from physical simulations and are available in a database. Using a database results in a short computation time.

Next, SkyFlow calculates from this image the scatter signal that a grid would remove at optimal alignment. That signal is subtracted from the original detector image, resulting in a scatter-corrected image with grid-like image contrast.

Hospital information

Hospital de la Santa Creu i Sant Pau in Barcelona is a university hospital established six centuries ago, making it the oldest hospital in Spain. The hospital is among the most relevant for education and research in the country.

An historical complex and a new building block compose the hospital. The old structure is an example of modernist architecture, built at the beginnings of 20th century and declared World Heritage Site by UNESCO in 1997. The construction of the new hospital began in 2000 and was completed after ten years.

Patients admitted to the ICU at the Hospital de Santa Creu I Sant Pau: 30 % of patients are postsurgical heart, 16 % post general surgery, 21 % respiratory complications, 26 % rating vias and catheters and 7 % other.

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2. Rubinowitz AN, Siegel MD, Tocino I. Thoracic imaging in the ICU. *Crit Care Clin*. 2007;16:539-573
3. Mentrup D, Jockel S, Menser B, Neitzel U. Iterative scatter correction for grid-less bedside chest radiography: Performance for a chest phantom *Radiat Prot Dosimetry* 2016; 169 (1-4): 308-312

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