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Experience with POWER GLIDE in RADspeed Pro

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1. Hospital Overview

Fukuoka University Hospital **(Fig.1)** is committed to providing advanced and specialized medical care under the principle of "warm-hearted medical service." With 915 beds and about 1,950 staff across 23 clinical departments, we play a central role in regional healthcare and focus on medical collaboration aimed at "comprehensive regional healthcare." Uniquely, our hospital is directly connected to a subway station. On March 27, 2023, the extension of the Fukuoka City Subway Nanakuma Line is scheduled, improving accessibility from Hakata Station and the airport. By December 2023, a new main building is expected to be completed, enhancing the medical services we offer.

The radiology department, with 49 radiological technologists (as of September 2022), prioritizes patient service and interdisciplinary collaboration, striving to provide safe and efficient medical care. With eight general radiography rooms in the main and new buildings, we conduct about 6,000 radiography examinations monthly (in the fiscal year 2021). This report presents our experience using the RADspeed Pro equipped with the power-assist feature “POWER GLIDE” and Konica Minolta's Dynamic Digital Radiography Analysis Workstation "KINOSIS."

Fig.1 Anticipated completion of the new wing (top) and new main building (provisional name) of Fukuoka University Hospital

2. Background of Introduction

The updated radiography room, one of four in the main building primarily used for chest and abdominal imaging, previously had separate X-ray tubes for standing and supine positions. In selecting equipment, emphasis was placed on throughput and operability for chest and abdominal imaging. The newly introduced RADspeed Pro with POWER GLIDE **(Fig.2)** has a single X-ray tube, but the

Fig.2 System appearance

POWER GLIDE and auto-positioning features allow easy movement of the tube from standing to supine positions, expected to ensure throughput while reducing introduction costs. Moreover, with a high number of daily examinations, reducing the physical strain on radiographers was a key issue. POWER GLIDE, an appealing feature, led to the decision of its introduction. Additionally, the X-ray generator capable of sequential pulse irradiation allows for Dynamic Digital Radiography for the chest, which was previously impossible, using Konica Minolta's FPD "AeroDR fine."

3. System Configuration

To meet the diverse examination requests from various clinical departments, the general radiography room must accommodate basic skeletal imaging and special imaging like long view radiography. The system configuration allows Dynamic Digital Radiography for the chest to meet current and anticipated future needs, such as respiratory function analysis imaging.
Note: Details of Dynamic Digital Radiography for the chest are omitted as it's in the clinical preparation stage in our hospital.

4. Overview of POWER GLIDE Feature

POWER GLIDE, with an internal motor drive, enables operators to maneuver the X-ray tube with less effort. A force sensor, only a few centimeters thick, is installed on the back of the handle to detect the operating force. The POWER GLIDE motor, located in the ceiling-mounted section, makes no significant visual difference compared to other RADspeed Pro rooms without this feature. The method of operation also remains largely unchanged, enhancing usability without any discomfort. The assist level is adjustable to High/Middle/Low, suiting various situations in the examination room. The assist level can be easily switched via the LCD screen on the handle, reducing stress during examinations. Additionally, turning on the collimator lamp automatically switches the assist level to Low, facilitating fine adjustments before exposure. When the lamp is turned off, it reverts to the original assist level, making post-imaging patient transfers easier. POWER GLIDE also includes customization features for acceleration, deceleration, and maximum speed for each movement axis, allowing users to adjust the feel of use according to each facility's examination types and room sizes (Fig.3).

Fig.3 POWER GLIDE assist level adjustment screen (top) and customization screen (bottom)

5. Experience with POWER GLIDE

In general radiography, radiological technologists often manually operate equipment, including moving the X-ray tube, more frequently than in other modalities. Given the high number of examinations, this leads to increased patient transfers and equipment handling, consequently increasing physical strain on the radiographers. For supine imaging, the basic practice is to retract the X-ray tube towards the ceiling post-imaging. However, moving the 300 kg equipment can be challenging for shorter or less physically strong technologists. With POWER GLIDE, even our female technologists with less strength can easily

pull down the tube from its retracted position with minimal effort (Fig.4). Their feedback confirms significant reduction in physical strain, indicating the high assistive performance of POWER GLIDE.

Fig.4 Operation at the retracted position

6. Overview and Experience with the Single-Axis Movement Button

Traditionally, RADspeed Pro has rear switches on the back of the X-ray tube support, enabling operations like vertical rotation, all-free, collimator lighting, and emergency stop. A new single-axis movement button has been added to the X-ray tube support equipped with POWER GLIDE. This function allows for automatic movement when pressed and is usable for transferring the X-ray tube between staff and for aligning the tube from the back (Fig.5). In the radiography room, there are often situations where it's not possible to operate the X-ray tube from the front, especially in emergency imaging scenarios requiring rapid and safe responses, often involving multiple technologists. This button allows smooth transfer of the X-ray tube to staff positioned on the opposite side of the table and facilitates equipment movement to the next position. In equipment without rear switches, transferring the X-ray tube was done using vertical axis rotation, but this equipment allows linear transfers, reducing the risk of contact with drip stands or other staff.

During emergency imaging, medical staff other than radiological technologists may assist, and the radiographer needs to be mindful of patient positioning and condition. Being able to operate the X-ray tube with one hand is extremely beneficial. In fact, the use of POWER GLIDE-equipped radiography rooms for emergency patients has increased at our hospital.

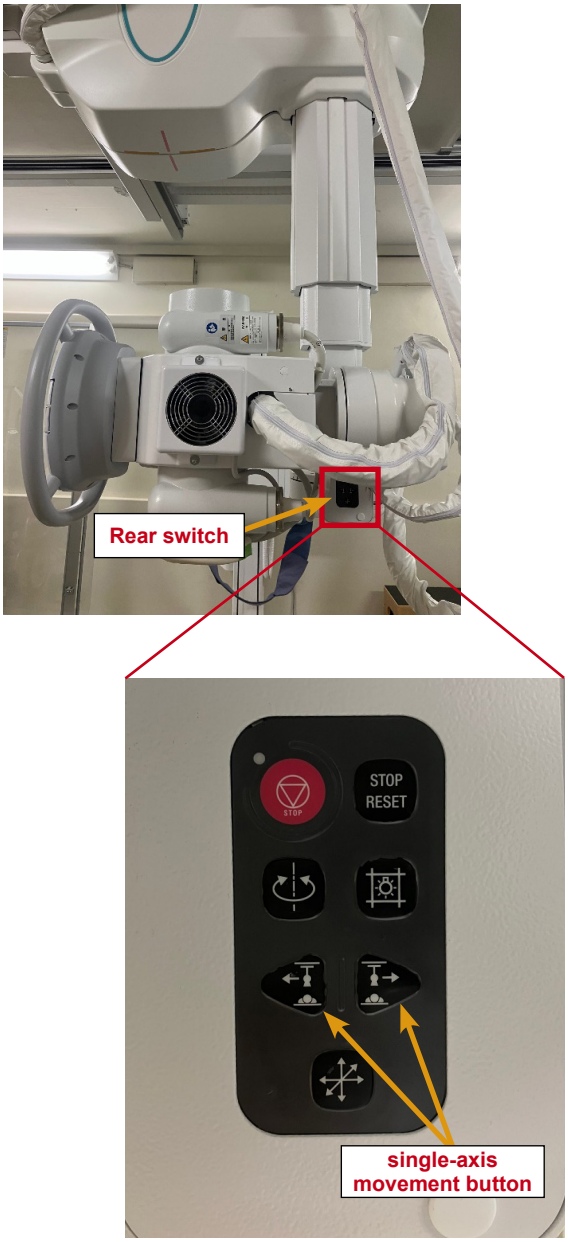

Fig.5 Rear switch (top) and single-axis movement button (bottom)

7. Other Functions Available at Our Hospital

7.1 Long View Radiography

Both standing and supine positions are possible. Standing position is performed with a fender wall set up in front of the bucky stand. The fender wall's platform is about 20 cm above the floor, with a pull-

out step to accommodate patients with limited leg mobility. Positioning involves aligning the heels with the back of the fender wall, which is equipped with handrails to help patients maintain their posture. For both standing and supine positions, setting the exposure range is generally sufficient. However, in standing position, it's important to remove hand grip for lateral radiography from the stand, and for supine position, it's crucial to lower the table to its lowest position to achieve maximum SID. If these are overlooked during setting, the situation can be quickly checked via the information button on the operating handle's LCD screen.

Long view radiography is conducted up to three exposures (four exposures as per specifications) depending on the exposure range. The angle of the X-ray tube changes automatically with each exposure, and the FPD moves to capture the images. The captured images are immediately and automatically stitched together for review. For full-leg radiography in a standing position, the entire process takes about 18 seconds for three exposures, and then an additional 8 seconds for the stitched image to be displayed.

7.2 Dynamic Imaging

With the introduction of RADspeed Pro, Konica Minolta's dynamic digital radiography analysis workstation "KINOSIS" has also been implemented, and we plan to start using Dynamic Digital Radiography for the chest clinically in the future. Once operational, this will allow for quantification of various movements, such as alveoli, pulmonary vessels, and the diaphragm, visualizing motions not observable in general radiography. The analysis results can be referenced on terminals in the hospital via PACS linkage and web access. Our hospital plans to use this as a preliminary step before detailed examinations like CT, MRI, and RI, with great expectations for the convenience of conducting these examinations in a general radiography room.

8. Conclusion

POWER GLIDE contributes not only to reducing the physical strain of radiographers but also to shortening examination times due to its ease of operation. Additionally, the reduced physical strain means radiographers are less likely to feel fatigued, even during busy periods, potentially reducing human errors. The ease of single-handed operation also allows for increased attention to safety around patients, contributing to overall safety improvements.

On the other hand, technologists unaccustomed to POWER GLIDE have expressed difficulty in adjusting the force due to its high assist capability, leading us to implement prior operational training as a safety measure. We also ensure, as with conventional equipment , to maintain a sufficient distance from the patient during operation.

POWER GLIDE significantly improves the operability of the X-ray tube, allowing for flexible response during various scenarios during examination and contributing to the reduction of physical strain on the radiography staff. It is a feature considerate of the current medical field conditions.