Roll-Film Changer for Whole-Limb Angiography: A Trial Production and Its Clinical Application

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Abstract. We have developed an automatic roll-film changer (25 x 90 cm) for whole limb angiography that is equipped with a pair of graduated intensifying screens and a stationary grid. Satisfactory intermittent closure of the screens is achieved by mechanical means. The filming program can be set at one exposure every one to five seconds. A total of 20 serial angiograms can be obtained.

In both experimental studies and clinical series, the roll-film changer has proved to be a valuable asset in angiographic evaluation of occlusive arterial diseases of the lower extremities.

Key words: Angiography, equipment – Venography.

Technical Aspects and Clinical Experience

Our film changer is similar to the Matsuki roll-film changer, which is widely used for serial angiography in Japan, except that the angiographic field is enlarged to a 10 x 36 inch size. The changer consists of the body, the supply and receiving magazines, and the stand, as shown in Figure 1. The body of changer can be easily taken off the stand and used on the floor, since a focus-to-film distance of 150 cm or more is required. The changer is relatively compact and can also be tilted 60 degrees to permit phlebography of the lower extremity in the semi-erect position. Both magazines can hold a 24.5 cm x 20 m roll of film, and they can be attached to or detached from the body in daylight. The body of the changer holds a Kyokko US-II screen and a long stationary grid (10 x 36 inch in size, 6.1 grid ratio, 34 lines/cm grid density) is mounted on the angiographic field. The roll-film is pulled between the two intensifying screens and wound up intermittently on the spool in the receiving magazine. Intermittent film-screen contact is achieved mechanically by two cams. The central x-ray beam is always directed perpendicularly to the center of the changer's field. The focus-film distance (FFD) is kept at 150 cm or more, if possible, and the x-ray tube is placed parallel to the long axis of changer with its anode on the pedal side. An exposure rate of one film every one to five seconds can be chosen on the program selector. Two or three different combinations of exposure rate can be selected for an angiographic series; for femoral angiography the authors presently use rate of one film per second for the first ten films and one film every two seconds for the next ten films. Twenty films can be taken on a roll film of 20 meters. Since the filming number can be pre-selected, two or three angiographic series can be obtained on a roll of film.

Experimental and Clinical Studies

The roll-film changer is used with a Kyokko US-II screen, a combination of intensifying screens with a gradual change from high speed to low speed, as shown in Figure 2. Practically uniform density throughout the radiographic image of a limb-phantom could be obtained by using the US-II screen. Though better uniformity could be attained with a longer FFD, we selected 150 cm FFD for the sake of clinical practice. As far as the effect of tube voltage on the uniformity in density of the limb-phantom...
Fig. 1A and B. Roll-film changer. A The body with supply and receiving magazines taken off from the stand. The body is 1.410 mm in length, 377 mm in width, and 285 mm in height. B A 60-degree-tilted changer for ascending phlebography of the lower extremity.

was concerned, there was no essential difference in the range from 80 to 110 kVp.

The broken line in Fig. 3 indicates MTF of the spatial frequency 2.0 LP/mm at various points on a combination of the US-II screen and Fuji RX film

Fig. 2. Characteristics of Kyokko US-II Screen. The limb-phantom, which contains water, was constructed by us. The point A is representative of ankle (8 x 8 cm in cross-section), the point B the center of the changer or knee, (13 x 13 cm) and the point C the upper thigh (18 x 18 cm).

Fig. 3. MTF (2 LP/mm spatial frequency) at the points A, B, and C. MFD: the distance between the test chart and the surface of the cassette holding the Kyokko US-II screen.