Technical methods

A serial whole-organ slicing technique for examining surgically resected breasts

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Routine methods of examining surgically resected breasts and the axillary lymph nodes are often perfunctory (Symmers, 1966). Much significant information—of direct importance to the individual patient submitted to surgical mastectomy—may be missed in techniques which often entail perhaps half a dozen slices of the corpus mammae and a variable quantity of the axillary contents.

The method of examination to be described has proved to be easily applicable to routinely received surgically excised breasts and yields considerably more information than hand-slicing techniques.

Method

Breasts are submitted within a few hours of surgical excision to the histopathology department. Initially no attempt to fix them is made. They are wrapped in metal cooking foil, moulded to anatomical shape, and chilled (0–4°C) either overnight or for several hours until the organ becomes inflexible. Careful expression of air pockets from the foil wrapping aids heat conduction. More profound chilling, with its problem of ice-crystal artefacts, is unnecessary.

After the fat has hardened sufficiently the external features, dimensions and visible abnormalities of the organ are described; a protocol is useful for this purpose. The breast is then sliced whole, horizontally, usually in the coronal or sagittal plane on a commercial gravity-feed meat slicer (model GF30, Messrs Berkel, London) that is equipped with an electrically operated circular blade and safety shielding. The most useful depth at which to section is 4–5 mm (adjustable slicing depths are provided on the machine), which allows detailed soft-tissue radiography and full-depth paraffin blocking of the slices. Cutting the first few slices usually requires

manual support of the specimen, but subsequent slicing may be left to the automatic gravity-feed mechanism.

The slices received on the tray of the slicing machine are transferred in serial order to sheets of dry paper towelling (Bowtowels, Messrs Bowater Scott), taking care to maintain correct orientation of the individual slices. Because of the need to orientate the individual slices, a manually operated machine is preferable to one with an automatic mechanism. Depending on the size of the breast and the plane of sectioning some 30–50 slices are usually obtained.

The paper towelling to receive the slices is laid on perforated plastic sheets (40 × 40 × 0.4 cm). The individual slices are identified by placing beside them numeral discs (PVC rigid engraving plate, white-red-white) that have been deeply engraved. In order to prevent dissociation during fixation the slices are then covered by a further layer of paper towels which are lightly pressed on to the slices. Fixation is effected by immersing the layers of plastic sheets carrying the slices in an adequate volume of 4% formaldehyde in buffered saline. Convenient plastic dishes for fixation (internal dimensions 41 × 41 × 8 cm) are manufactured by Messrs Grannell, London.

The macroscopic description of the whole-organ slices is written after overnight fixation. It is useful to describe the main landmarks (nipple, surgical incision, and cavity, biopsy needle track, main and smaller tumours, and axillary lymph nodes) in terms of the slices that they occupy. If a complete record of the case is wanted, the entire set of slices is then photographed (both colour transparencies and black-and-white prints are useful) and radiographs of the slices are prepared. Alternatively, only selected slices are so treated.

The radiographs of the whole-organ slices were prepared employing a Sengraphe (CGR, France) mammography machine (exposure: 19 KV, 20 Ma, 6.0 sec) and 3M type S film with RP processing in 90 sec. It was found essential to remove excess formalin droplets from the specimens before exposure. The engraved numeral plates proved satisfactorily photogenic and radiotranslucent.

Thereafter appropriate tissue blocks are taken for paraffin embedding. The relevant areas are selected by naked-eye examination of the slices, inspection of the radiographs, and if desired, dissecting micro-

scopy of the tissue. The blocks for correlation with the tissue-slice radiographs are precisely obtained by means of tracing-paper representations of the abnormalities found on the *x*-ray plates. Needles inserted through the corners of selected rectangles on the tracing paper that is superimposed on the tissue slices are convenient markers whereby the requisite tissue may be identified. Staining of the paraffin sections with haematoxylin and eosin is sufficient in most instances, but Hart's modification of Weigert's elastic van Gieson procedure (Culling, 1963) and von Kóssa's method for 'calcium' (Pearse, 1972) are useful in comparing histological with radiographic appearances.

The whole-organ slices are stored in plastic bags containing fixative. The photographic record of the slices allows subsequent three-dimensional reconstruction of the specimen if it is necessary at a later date.

Comment

The virtues of this method of examining surgically resected breasts, a modification for routine use of those by Egan, Ellis, and Powell (1969), and Gallagher and Martin (1969) are considerable. It is simple to perform, aesthetically less unpleasant than methods that involve examining fields of warm molten fatty tissue, and may be taught to the relatively inexperienced pathologists who are often responsible for surgical cut-up procedures.

The extent of the tumour is revealed more clearly

than in traditional methods. The relationship between planes of surgical excision and the tumour margin is well preserved because the possible errors of differential shrinkage during fixation of partly incised tissues are eliminated. The presence of intramammary tumour spread and independent primary tumours are also more easily detectable.

Finally, the method allows correlation of histopathological findings with radiographic appearances. Both soft tissue opacities and areas in which frank calcification has occurred are available for examination.

The major cost of the method is the modest price of the meat slicer. This, however, appears justifiable in that it is easily adaptable to fine slicing of other organs, particularly spleens resected at laparotomy from subjects with Hodgkin's disease, and there is considerably less need for the waste of time entailed in reblocking tissue for histological examination of the primary mammary tumour and axillary lymph nodes.

References

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