Virchows Arch [Pathol Anat] (1985) 406:279–284

Virchows Archiv A

The distribution of liver metastases from colonic cancer

A quantitative postmortem study

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Summary. 54 livers of patients with colonic cancer were investigated in a postmortem study. 26 livers contained metastases from colon carcinoma. Assessment of the number, size and location of metastases was made. The possible interdependence of the site of the colonic primary and the location of its secondaries in the liver was examined. Results suggest an approximately homogenous distribution of metastases from colonic cancer in the hepatic parenchyma, irrespective of the location of the primary tumour.

Key words: Colon carcinoma – Liver metastases – Portal blood flow

Introduction

Liver metastases from colonic cancer are surgically removed at an increasing frequency especially if only solitary lesions or few metastases restricted to one lobe are found (Angermann and Gall 1983; Rajpal et al. 1982; Mühe and Gall 1979; Hegemann and Mühe 1976; Nielsen et al. 1971). The 3-year survival rate for patients with no evidence of metastatic disease outside the liver is estimated to be 66% after hepatic resection. Fortner et al. (1984). A systematic attempt to analyse the topography of hepatic metastases from colonic cancer has not yet been made.

From the theory of double circulation within the portal vein, still a currently accepted view in the literature (Bolk and Machnik 1978), a specific pattern of metastatic distribution would be expected. Secondary deposits would be located in specific parts of the liver depending on whether the primary tumour was drained by the vena mesenterica sup. or by the vena mesenterica inf. (Sérégé 1901; Henschen 1932; Copher and Dick 1928). The basis for this view is experimental studies which suggest the existence of segregated blood-streams within the portal vein. The authors concluded

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that impaired mixing of mesenteric and splenic bloodflow would lead to a selective distribution of these blood streams to the liver, thus tumour cells from cancer of the right colon would rather be delivered to the right half of the liver, whereas the left half would be the main target area for metastases from cancers located in the left part of the colon. In addition it is not known whether there is a preferential metastatic involvement of the liver surface or its depths. The purpose of this study was to find out whether there is a specific pattern in the distribution of hepatic metastases from colonic cancer of different locations, or if they appear at random within the liver.

Material and methods

54 unselected livers of patients suffering from colonic cancer were investigated in an autopsy study. Histologically all tumors were adenocarcinomas. Because of its dual venous drainage carcinomas located in the rectum were not considered.

Livers were frozen and cut sagitally into slices of 1 cm thickness, parallel to the gallbladder – caval line, which represents the physiological division between the liver halves. 26 livers contained metastases from colonic cancer. An exact cartography of all slices of these 26 livers was made, mapping all metastases sectioned. Metastases were counted and their size measured. Mean diameter was determined. The exact topography of tumor seedlings was recorded. This included registration of location of the secondaries in the half of the liver in which they occurred and whether they occurred in superficial or deep parts of the hepatic parenchyma. Finally, we formed two groups of livers according to the site of the primary in the right or left part of the colon, and the incidence of metastases in the halves of the liver was correlated with the location of the colonic primary.

Results

1. Number and size of metastases

54 livers were investigated. 26 showed metastatic disease. 1571 tumour lesions were assessed, averaging 62 metastases per liver. Metastasis size ranged from 0.2 cm to 9.0 cm with a mean diameter of 1.4 cm. The largest solitary lesion measured 2.5 cm. The smallest solitary one had a diameter of 0.5 cm and was buried deep inside the liver. 11 livers contained a maximum of 10 metastases each.

2. Location of metastases in the two halves of the liver

The percentage of metastatic involvement of the two halves of the liver is shown in Fig. 1. The overall incidence of metastases located in the right half was 61.2% compaired to 38.8% located in the left half. Results were similar for right and left sided colonic cancers: 63% of metastases from 20 primaries located in the left part of colon we found in the right side of the liver, wereas 37% were located in the left half. The results for the 6 right-colon primaries were 57% in the right half versus 43% in the left. In the group of livers with a maximum of 10 metastases, a comparable

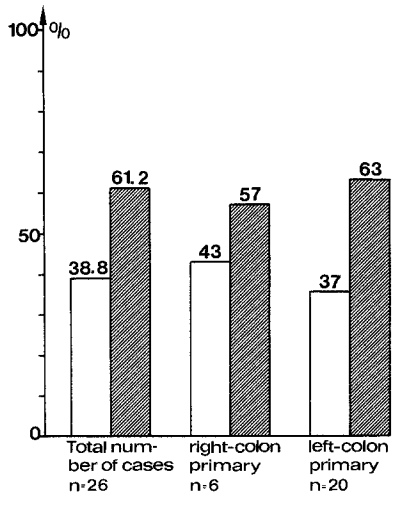

Fig. 1. Percentage of metastases in the two halves of the liver in colonic cancer at different locations (▨ = right liver half; □ = left liver half)

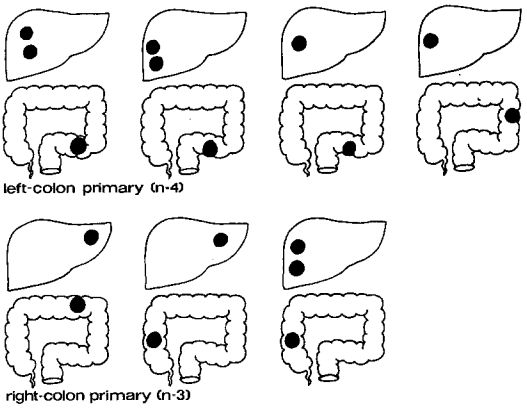

Fig. 2. Schematic illustration of the seat of the colonic primary and the location of metastases, when only one half of the liver is involved

modes of metastatic distribution was observed with 70% of metastases located in the right half of the liver and 30% in the left.

In 7 livers metastatic involvement was limited to one half. 4 of these livers contained a solitary lesion each, 3 had 2 metastases each. The relationship of the site of the colon primary and location of its secondaries in this group is shown in Fig. 2. Very obviously, tumours did not show a tendency to metastasize to the corresponding half of the liver. We even found evidence of an inverse relationship, with the contralateral half more often being the affected part.

3. Superficial and occult metastases

49% of metastases reached to the liver surface while 51% were occult, deep in the liver parenchyma. 2 livers presented superficial metastases

only, one of these showed a solitary lesion, the other one had 2 metastatic nodules. In 4 cases all tumour deposits with a maximum of 2 metastases were located within the liver parenchyma, the liver surface was unremarkable.

4. Solitary metastases

4 livers (16%) contained a solitary lesion. This was occult in 3 livers, measuring 0,5 cm, 0,9 cm and 2,5 cm respectively. The fourth liver in this group had a small superficial deposit with a diameter of 0,3 cm.

Discussion

There are few clinical and autopsy data concerning the topography of hepatic metastases – the information being little more than vague (Walther 1948; Ozarda and Pickren 1962). In a recent monograph of Weiss and Gilbert (1982) various aspects of liver metastases are covered, however, the distribution of tumour deposits in the hepatic parenchyma is not analyzed.

Dionne (1965) investigated the pattern of blood-borne metastases from rectal cancer and discussed the possible relationship of the site of the primary and the location of its secondaries in the liver. In this context he mentioned the concept of a douple circulation within the portal vein, previously described by Sérégé (1901), and Copher and Dick (1928). Dionne considered the theory not to be tenable, at least as far the dissemination and implantation of blood-borne cancer cells was concerned. His study, however, only dealt with rectal cancer. As the conditions of venous metastatic spread in colonic cancer are probably different from rectal lesions, we took a special interest in the idea of the streamline phenomenon, i.e. the "double circulation" within the portal vein, using a previously described and rather simple method to re-examine its validity. (Schulz and Hort 1981). We found the majority of metastases located in the right half of the liver. This does not imply a preferential involvement of this area, since it has been established that in adults the right half weights about twice as much as the left (Kalbfleisch 1973) and will probably receive a proportionate amount of blood. Accordingly we found a good correlation between the weight of the halves and the number of metastases (Fig. 3). Our results, therefore indicate an approximately homogeneous distribution of tumour deposits within the hepatic parenchyma. Furthermore, in cases of solitary lesions no interdependence of location of primary and metastases could be demonstrated.

The concept of a uniform distribution of liver metastases is supported by our data on metastatic involvement of the hepatic surface and the internal liver parenchyma by superficial and deep metastases. 51% of metastases were occult whereas 49% reached the liver surface. The last value corresponds well with the results of a recent investigation, in which Schulz and Hort (1981) demonstrated that a superficial liver – tissue mantle of 1 cm thickness comprises almost half of the total liver mass. With a mean metasta-

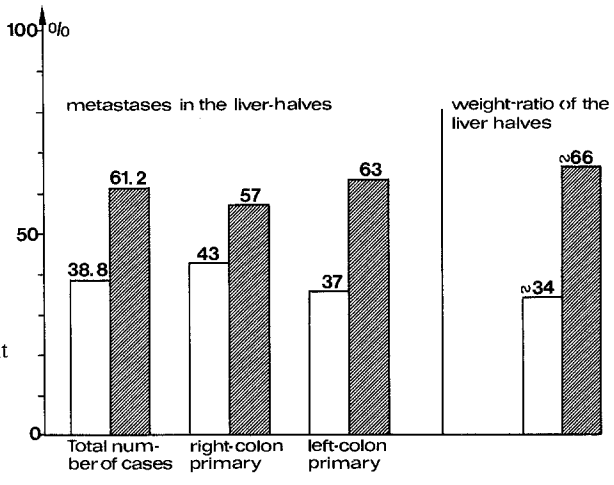

Fig. 3. Distribution of hepatic metastases in colonic cancer, compared with the relative weight of the two halves of the liver (▨ = right liver half; □ = left liver half)

sis diameter of 1,4 cm in this study the vast majority of superficial tumour deposits will be situated in this liver – tissue mantle.

According to the theory of a dual portal flow within the portal vein, we would have expected a selective distribution of tumour cells in the different areas of the liver, depending on the venous drainage of the primary. The concept of streamlining has already been challenged by other investigators, using a varity of techniques (Groszmann 1971; Cole 1956; Wakabayashi 1937). The findings in the present study confirm the absence of a dual portal flow. Summing up our data we find that tumour cells from colonic cancer are most likely delivered evenly to any part of the liver, thus leading to a homogeneous development of metastases. Consequently, knowledge of the location of the primary in the colon will not enable us to predict the site of appearance of its hepatic metastases.

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Accepted February 28, 1985