

## OMENTAL MILKY SPOTS ARE SPLENOID IN NATURE

Nobuo Takemori

**Abstract** The omentum contains peculiar lymphoid tissues termed omental milky spots. In NZB mice, omental milky spots show extramedullary neutrophilic myelopoiesis and megakaryopoiesis. Similar milky spots (splenoportal milky spots), which also show similar hematopoiesis, are present in the splenoportal fat band developing along the splenic artery. The splenoportal fat band contains sporadic aberrant spleens. In addition, transitional forms between splenoportal milky spots and aberrant spleens are occasionally present in the fat band. These three types of lymphoid tissues in the fat band are supplied by branches of the splenic artery. Based upon the blood vessel supply, the extramedullary hematopoiesis and the morphological transition from aberrant spleens via transitional forms to splenoportal milky spots, splenoportal milky spots seem to represent splenoid lymphoid tissues. Taking into account the similarity between omental and splenoportal milky spots, the deduction that omental milky spots also represent splenoid lymphoid tissues may be made. The function and the significance of milky spots are described in this paper.

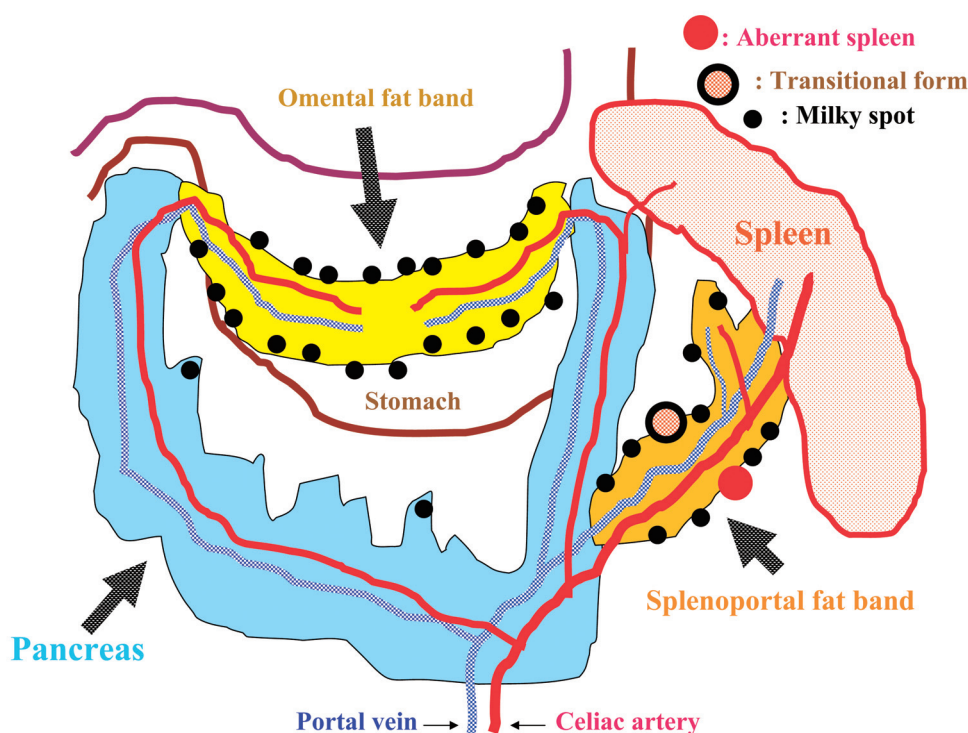
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**Key words:** omentum; milky spot; function; spleen

The omentum is not only a simple fatty tissue, but also it contains peculiar lymphoid tissues called “omental milky spots”. Generally, omental milky spots are known to have the following functions:

- 1) They represent a major immune system in the peritoneal cavity.
- 2) They produce free peritoneal cells, such as macrophages/monocytes and lymphocytes.
- 3) They are a major gate through which circulating inflammatory cells (e.g., granulocytes, monocytes, and lymphocytes) migrate from omental vessels into the peritoneal cavity.
- 4) They play an important role in scavenging foreign substances in the peritoneal cavity.
- 5) They produce ascites by filtering fluid from the capillaries to the peritoneal cavity.
- 6) They show extramedullary hematopoiesis.

With respect to the nature of omental milky spots, Koten and den Otter<sup>1)</sup> suggested that omental milky spots represent an intestinal thymus. However, their claim seems improbable because the lymphocytes in omental milky spots are exclusively composed of B-cells, and there is no anatomical correlation between the thymus and omental milky spots. Moreover, unlike the thymus, omental milky spots are absent at birth<sup>2)</sup>. On the other hand, we have surmised that omental milky spots are splenoid in nature based on the observations of mouse omental milky spots and lymphoid tissues developing along the splenic artery at the hilum of the spleen<sup>3,4)</sup>. The structure of the omentum in mammals is basically similar. In particular, the mouse omentum is simple in structure and is helpful in understanding the nature of the omentum. The mouse omentum consists of omental membranes and a band-like adipose tissue (i.e., omental fat band). This fat band



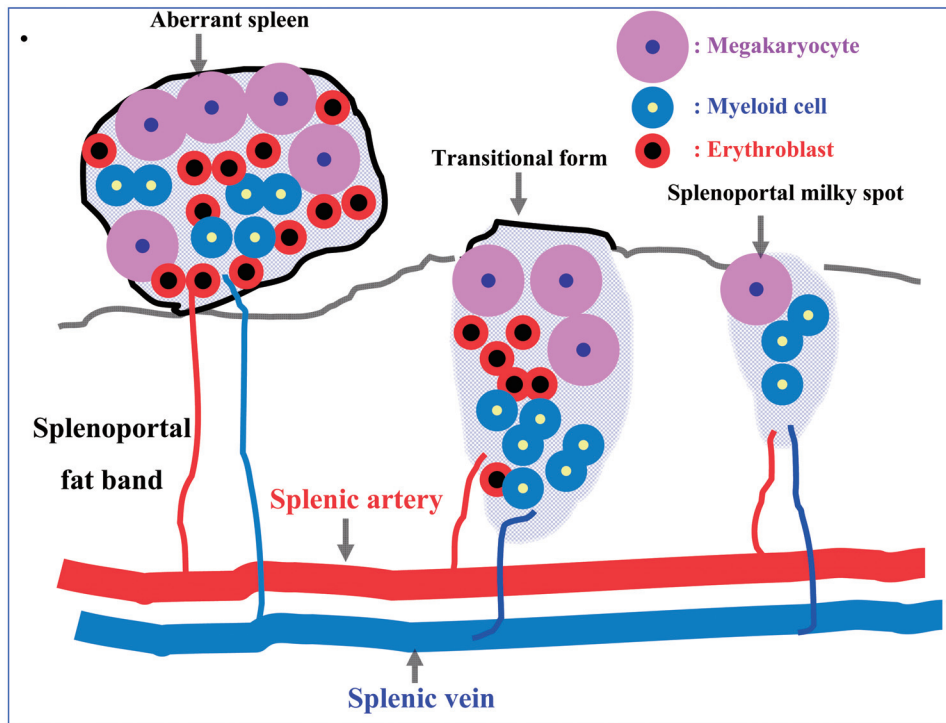
**Figure 1** Schematic drawing showing the relationship between the omentum, spleen, and pancreas. Omental milky spots are indicated by black dots. Similar milky spots (i.e., splenoportal milky spots) are also present in the splenoportal fat band.

contains abundant vascularized lymphoid tissues (i.e., omental milky spots)<sup>2,5</sup>. These milky spots are supplied with offshoots from the right and left gastroepiploic arteries. It should be noted that the left gastroepiploic artery is an offshoot from the splenic artery. From the viewpoint of the blood vessel supply in the omentum, there seems to be a close relationship between omental milky spots and the spleen (Figure 1).

In normal mice, omental milky spots consist of abundant lymphocytes together with macrophages, plasma cells, granulocytes, and various stromal cells<sup>2,5</sup>. In addition, neutrophilic myelopoiesis is occasionally seen in omental milky spots of normal mice<sup>2,5</sup>. However, neither erythropoiesis nor megakaryopoiesis is seen in omental milky spots of normal mice<sup>2,5</sup>. We found that New Zealand Black mice have well developed omental milky spots. In this strain, sporadic

megakaryopoiesis as well as active neutrophilic myelopoiesis are seen in omental milky spots<sup>3</sup>. In addition, we demonstrated that similar milky spots (i.e., splenoportal milky spots) are abundantly present in the fat band (i.e., splenoportal fat band) developing along the splenic artery at the hilum of the spleen<sup>3,4</sup>. Moreover, transitional forms (between splenoportal milky spots and aberrant spleens) and aberrant spleens are sometimes seen in the splenoportal fat band<sup>4</sup>. These three types of lymphoid tissues (splenoportal milky spots, transitional forms, and aberrant spleens) in the splenoportal fat band are similarly supplied with direct offshoots from the splenic artery (Figure 2). Mouse spleens are known to show active hematopoiesis including granulopoiesis, erythropoiesis, and megakaryopoiesis. Aberrant spleens show similar hematopoiesis<sup>4</sup>.

Furthermore, transitional forms also show



**Figure 2** Schematic drawing showing the splenoportal milky spot, the transitional form, and the aberrant spleen. The transitional form shares the features characteristic of the splenoportal milky spot and the aberrant spleen. It should be noted that these lymphoid tissues are supplied with direct branches from the splenic artery.

hematopoiesis of three cell lineages<sup>4)</sup>. Our recent study demonstrated that erythropoiesis can be induced by intraperitoneal administration of erythropoietin in omental milky spots in normal mice<sup>5)</sup>. This shows that omental milky spots have latent erythropoietic ability. Based upon the blood vessel supply, extramedullary hematopoiesis, and morphological transition from aberrant spleens, via transitional forms, to splenoportal milky spots, splenoportal milky spots seem to represent splenoid lymphoid tissues. Taking into account the similarity between omental and splenoportal milky spots, the deduction that omental milky spots also represent splenoid lymphoid tissues may be made.

Many investigators have used the peritoneal macrophages and lymphocytes for various immunological experiments because these cells

are abundantly present in the peritoneal cavity. However, there are few investigators who appreciate the origin of these cells in connection with omental and splenoportal milky spots. Here, we emphasize that the recognition of the splenoid nature of milky spots is a prerequisite for the correct evaluation of the experiments using such a peritoneal immunological system. In view of the hematopoietic ability of milky spots, the omentum as a hematopoietic organ should be appreciated, as well.

## References

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