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Serum Iron and Total Iron Binding Capacity in Larynx Cancer Patients Treated with Surgery

Żelazo i całkowita zdolność wiązania żelaza w surowicy chorych na raka krtani leczonych operacyjnie

Железо и полная способность связывания железа в сыворотке крови больных раком гортани леченых хирургически

A decrease in serum iron and total iron binding capacity (TIBC) has been seen in patients with various malignancies (5, 17, 18). Similar iron level and TIBC alterations we have found in patients with larynx cancer (13, 14). Estimation of TIBC reflects the quantity of transferrin which is the iron carrier in serum.

The serum iron and transferrin changes cannot be used for diagnostic purposes because they are not specific to malignancies. Such alterations have been also seen in inflammatory and infectious diseases, heart infarct and anaemias (2—5, 16). However, it is of interest whether elimination of neoplastic tissue from an organism brings back the decreased serum iron and TIBC to normal values.

The aim of the present study was to assess serum iron and TIBC in larynx cancer patients treated with radical surgery.

MATERIAL AND METHODS

Clinical studies were performed in a group of 46 people aged 20—66 years, including 30 patients with larynx cancer and 16 healthy subjects used as controls. Larynx cancer was proved histologically. History, medical and radiological examinations and basic laboratory tests did not show any other diseases which could influence serum iron or TIBC.

In all patients with larynx cancer the whole larynx was removed together with a tumour and in some patients with radical neck dissection. The surgery was performed under general anaesthesia. If blood loss during surgery exceeded 500 ml, it was replaced with an appropriate blood transfusion. Haemoglobin and red cell count before and after surgery were within normal limits.

In the control group one estimation of serum iron and TIBC was performed, whereas in cancer patients four measurements were carried out: 1) before surgery, 2) five days after, 3) a month after and

4) a year after surgery. During a year of follow up observation no signs of cancer recurrence were recorded in any patient.

The blood for tests was taken before breakfast. Serum iron was determined following the method of London and Marymont (6) modified by Śliwińska (15). TIBC was measured according to Ramsay (11). Student's *t*-test was used for statistical analysis.

RESULTS

The mean serum iron level in the control group was 19.0 $\mu\text{mol/l}$ and the standard deviation was 3.4. The mean iron level in the patients with larynx cancer before surgery was 16.0 $\mu\text{mol/l}$ and it was significantly lower than that of the controls. The decreased iron values (lower than the mean + 2 *SD* of controls) were found in 37% of cancer patients. Five days after surgery a marked and statistically significant drop in iron level was found compared to the preoperative measurement and decreased iron levels were encountered in 77% of the patients. A month after surgery, serum iron returned to the preoperative level and a year after — serum iron increased significantly to reach the values of the control group (Table 1, Fig. 1).

Table 1. Serum iron and TIBC in larynx cancer patients treated with surgery

	Measur- ement	Mean \pm standard deviation	A difference from control group		A difference from measurement 1	
			Value <i>t</i>	Proba- bility	Value <i>t</i>	Proba- bility
Iron $\mu\text{mol/l}$	1	16.0 \pm 6.1	2.07	0.050	—	—
	2	9.4 \pm 3.9	8.59	0.001	22.50	0.001
	3	14.6 \pm 4.0	3.96	0.001	1.08	0.050
	4	18.9 \pm 2.7	—	0.050	2.37	0.050
TIBC $\mu\text{mol/l}$	1	43.3 \pm 13.2	2.42	0.050	—	—
	2	35.1 \pm 10.4	5.29	0.001	26.10	0.001
	3	35.6 \pm 9.3	5.29	0.001	4.91	0.001
	4	40.6 \pm 8.0	3.81	0.001	1.44	0.050

Measurement: 1 — before surgery, 2 — 5 days after, 3 — a month after, 4 — a year after surgery.

The mean TIBC in the controls was 51.9 $\mu\text{mol/l}$ and standard deviation was 9.8. In the patients with larynx cancer the mean TIBC before surgery was 43.3 $\mu\text{mol/l}$ and it was significantly lower than that of the control group. The decreased TIBC values were found in 20% of larynx cancer patients. Five days and a month after surgery a further significant drop in TIBC was seen in relation to the preoperative estimation. A year after surgery TIBC increased to the preoperative level but in all measurements it was still significantly lower than normal values (Table 1, Fig. 1).

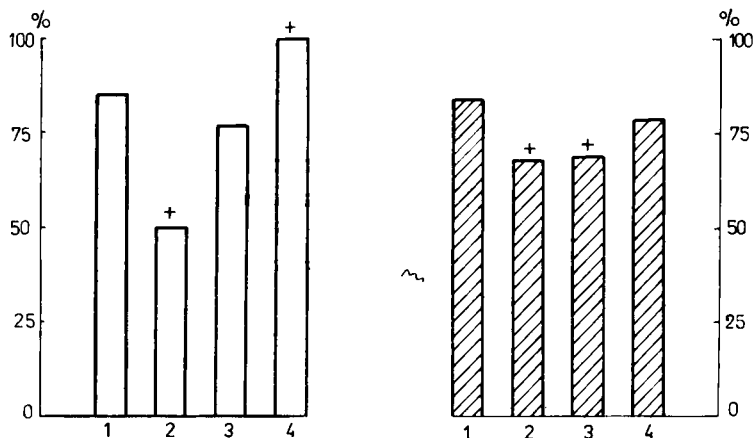


Fig. 1. Serum iron and TIBC in larynx cancer patients: 1 — before surgery, 2 — 5 days after, 3 — a month after and 4 — a year after surgery; the value of the control group accepted as 100%

DISCUSSION

Similar to our previous studies (13), a significant decrease in serum iron and TIBC was found in patients with larynx cancer compared with the controls despite the fact that the group examined included patients with moderately advanced cancer treated with surgery only. More advanced cases with regional or distant metastases were qualified for a combined or palliative treatment.

In relation to the preoperative measurement a significant decrease in serum iron was seen 5 days after surgery. A month after surgery serum iron returned to the preoperative level and a year after it, it increased to normal values.

A drop in serum iron was reported by others (1, 3, 9, 12) after various types of surgical operations. According to Baired and Podmore (1) the drop may result from: 1) insufficient release of iron from its storage places, 2) increased production of red blood cells, 3) storage of iron in the places of red cells breakdown. Rehn and Kümmell (12) think that the surgical trauma reduces the iron binding ability of transferrin.

Normalization of serum iron observed a year after surgery can indicate that excision of cancer tissue eliminates its effect on iron metabolism in the organism. Similar rise of serum iron after tumour excision was found in several patients by Miller et al. (7) and Wilke and Rentsch (17).

Estimation of TIBC in patients with larynx cancer showed that five days after surgical removal of a tumour a further drop in TIBC occurred in relation to the preoperative measurement. The decrease in TIBC was also seen by Postępski (10) following other surgical procedures. A year after operation TIBC returned to the preoperative value but it was still significantly lower than that of controls.

The decrease in TIBC after surgery is considered to result from an unspecific stress effect of surgical trauma (12). During a year of following observation of patients operated on the decreased TIBC it did not return to its normal value.

The studies demonstrated that a year after surgical removal of larynx cancer serum iron increased to normal levels whereas TIBC still remained decreased. Similar alterations in serum iron and TIBC are reported by us elsewhere (8) in patients with larynx cancer that underwent irradiation or a combined treatment with a good result. However, in patients with poor result of treatment (progression or recurrence of the disease) a further drop in iron level and TIBC was found in a year of following observation.

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STRESZCZENIE

W surowicy chorych na raka krtani stwierdzono obniżenie poziomu żelaza i całkowitej zdolności wiązania żelaza (CZWŻ). Po 5 dniach od usunięcia guza wystąpił dalszy spadek żelaza i CZWŻ. Po roku od operacji poziom żelaza wzrósł do wartości prawidłowej, natomiast CZWŻ osiągnęła jedynie wartość przedoperacyjną.

РЕЗЮМЕ

Снижение железа и полной способности связывания железа (ПССЖ) удостоверено в сыворотке крови больных раком гортани. Через пять дней после удаления опухоли выступило дальнейшее снижение железа и ПССЖ. Через год от операции уровень железа повысился к нормальной стоимости, зато ПССЖ повысилось только к предоперационному уровню.

