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HALIBUT LIVER POISONING IN 11 FISHERMEN

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Abstract. Eleven fishermen developed symptoms of acute vitamin A poisoning 5 hours after eating from 20 to 300 g of fried halibut liver, containing approximately 2–30 million units of vitamin A. The liver came from an unusually large halibut with a length of 2 m, which had been caught in the North Atlantic. The case history of one patient is reported in detail. The most striking symptom was the generalized desquamation of the skin, beginning 24 hours after the meal. Serum vitamin A levels were elevated in all.

Acute vitamin intoxication have been described as early as 1597 (20), but have only been recognized as such since the work of Rodahl & Moore in 1943 (17). Most descriptions were related to the eating of liver of polar mammals and fish by arctic travelers (3, 8, 9, 12, 19).

Recently we had the opportunity to observe a small epidemic of vitamin A intoxication in a group of 11 fishermen who ate fried halibut liver. They developed characteristic skin- and general symptoms and elevated serum vitamin levels. The most severely ill patient could be followed during the whole course of his illness, the others were followed at intervals.

Since such descriptions in the medical literature are relatively rare (1, 10, 13, 15, 16), we would like to record our findings.

Epidemiological data

On January 28, 1969, the trawler "Alida" (Scheveningen 6) was fishing near the Lofoten islands off the Norwegian coast at 70° N latitude. Around 5 p.m. the nets were hauled in. During the "stripping" of the catch, the liver of a very large halibut (length about 2 m) was put into the refrigerator for the crew's supper. It was fried later in large slices in salad oil and served with bread and salt at 7.30 p.m. The first engineer who did not like liver, did not join in the meal.

At 9 p.m. when the nets were hauled in again, everyone felt well. At 1 a.m., however, when the whole crew turned out for work again, all except the first engineer had become ill. The men complained of dull heavy headaches, dizzyness and nausea; 4 men vomited. The next day all men appeared to have redness and desquamation of the skin. All but one sailor felt better. Appetites were normal. When the home port, Scheveningen, was reached several members of the crew visited their family doctors to show their red, peeling skin. All were able to sail again a few days later.

CASE REPORT

One sailor, however, had symptoms severe enough to warrant consultation of a dermatologist. This was on February 6, one week after the ingestion of the fried liver. The sailor was a 23-year-old heavily built man with a weight of 90 kg and a height of 176 cm. He had eaten the largest amount of liver, approximately 300 g. The day after the meal he still felt dizzy. His face had been red and swollen, his arms, legs and chest also had shown erythema. There were no skin changes on the back. His temperature (taken by the skipper) had been normal. Patient had not vomited, there was no diarrhoea and his appetite was good.

Dermatological examination showed slight desquamation of the skin of the nasolabial folds, the presternal area and the medial side of the upper legs. There was no erythema to be observed. The main skin changes were concentrated on the palms of the hands (Fig. 1) and the soles of the feet. The palms were markedly erythematous and edematous; the horny layer was desquamating in thick yellow sheets. In the center of the palms, the skin under the loose layers of keratin contained air. The dorsal sides of the feet and hands showed only slight erythema. A punch biopsy was taken from an area of the left thenar which was not yet desquamating, on February 8.

During the following days there was marked improvement in the condition of the palms. Three weeks after the incident the skin of the palms had healed and only slight erythema was left. The desquamation of the skin of the soles started much later. It reached its maximum

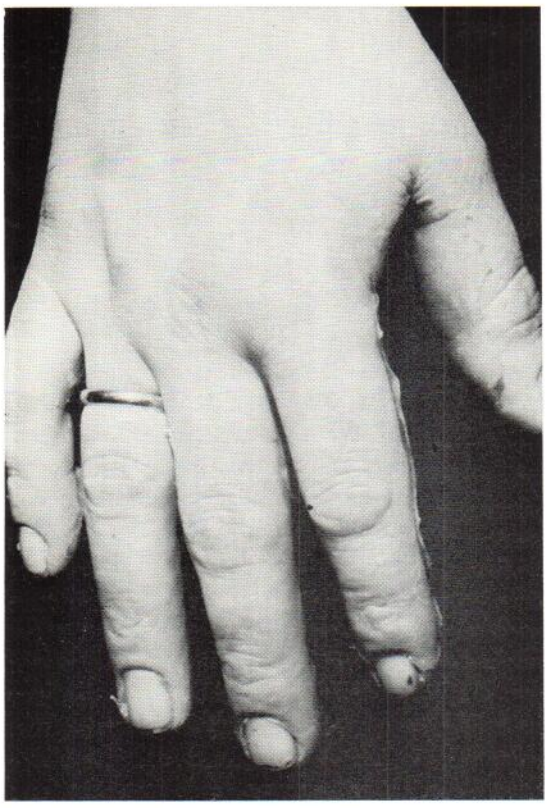

Fig. 1. Hand of the patient one week after the eating of the halibut liver.

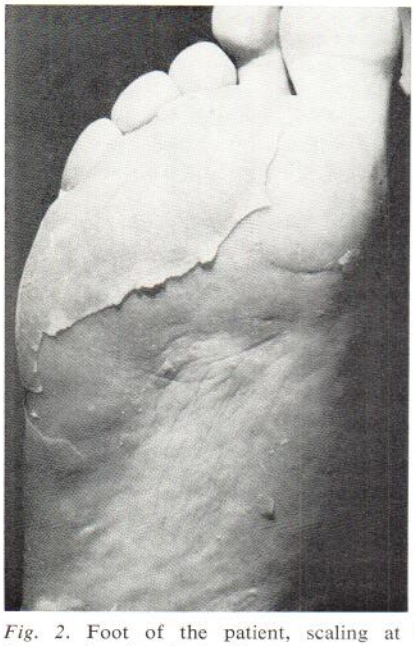

Fig. 2. Foot of the patient, scaling at its maximum, three weeks after the incident.

after 3 weeks (Fig. 2), compared to one week for the hands. The slight desquamation of the rest of the body had entirely disappeared by then.

Laboratory findings

Hemoglobin 18.1 g%, erythrocytes 5.04 mill., W.B.C. 5300/mm^3, bands 0, polymorphs 59, lymphocytes 32, monocytes 5, eosinophils 3, basophils 1. Blood sedimentation rate: 1/4. Total protein i.S.: 8.5 g%, alb.: 65.5%. Glob.: Alpha$_1$ 4%, Alpha$_2$ 7%, Beta 12%, Gamma 11.5%. Serum phosphorus 4.2 mg%, calcium 10.4 mg%, acid phosphatase 0.1 Bessey u., alkaline phosphatase 3.7 Bessey u., Thymol turbidity 1.8 u., ureum 36 mg%, creatinine 0.7 mg%, SGOT 27 u., SGPT 23 u., total bilirubin 0.5 mg%.

Serum lipids (non-fasting): total lipoid 1283 mg%, phospholipoid 12.9 mg%, cholesterol 379 mg%, esters 73%.

These values show no remarkable deviation from the normal, except a slight increase in the L.D.H., 410 u. (norm. 360 u.), which had returned to normal on February 6 (280 u.). The total lipoid and cholesterol values are elevated even for a non-fasting state. In view of the well-known bleeding tendencies in cases of chronic hypervitaminosis A, coagulation studies were performed; all values were within normal limits: recalcification time 187″, prothrombin time 15″ (control 15″), fibrinogen content 510 mg%, antithrombine immediate: normal, bleeding time 1′42″, thrombocytes 220,000 mm^2, hematocrit 51%, color serum normal.

Serum vitamin A levels

The serum vitamin A level on February 7 (10 days after the incident) was 250 i.u./100 ml (norm. 80–120 i.u.), due to an intervening weekend this value was not determined until 2 $^1/_2$ days after the sample was taken. It is known (5) that serum vitamin A levels may decrease by 50% on standing for several hours. Technically it was not possible to reduce this interval to less than 24 hours. The second determination on February 13, gave a value of 355 i.u., carotene 50 microgram (normal). It is possible that the first value may have been too low as a result of the delay between the taking of the sample and the determination. On March 20, 51 days after the meal his serum vitamin A level was 310 i.u./100 ml.

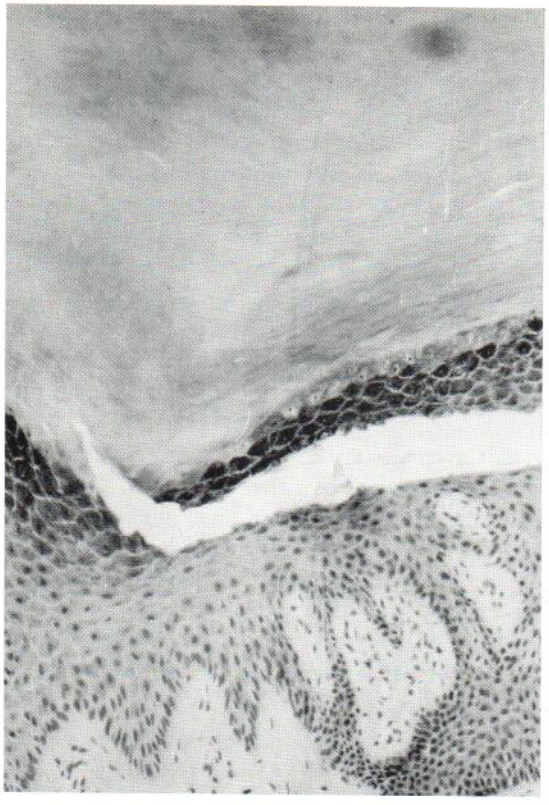

Fig. 3. Histologic section of the left thenar showing hyperkeratosis, acanthosis and hyperemia of the dermis (× 100).

Histopathologic findings (*Fig. 3*)

The biopsy specimen showed a piece of skin with a very wide horny layer, in which slit formation was noticed. The epidermis was built regularly. There was a very wide stratum granulosum. The rete ridges were wide, the dermal papillae narrow. There was some edema and lymphocytic infiltration round the blood vessels of the dermis.

Conclusion: hyperkeratosis, acanthosis and hyperemia of the dermis. These changes are compatible with the diagnosis of vitamin A intoxication.

Follow-up data on the other crew members

The remaining crew members of the "Alida" were examined after their return from another journey to the Lofoten, on February 25, 28 days after the incident. The results are shown in Table I.

On February 25 all patients showed desquamation of hands and feet. None had suffered from dizzyness or blurred vision. Vitamin A levels were elevated in all. The highest level was found in case 1, which is the patient described in full in this paper. The trawler was in port again on March 20, 51 days after the incident, and the crew could be inspected once more. All symptoms had disappeared. An exception was patient number 4, who developed strong desquamation of the horny layer of the soles of the feet in the first week of March, which was still present on March 20. No changes remained elsewhere on the body. Vitamin A levels could be determined again in patients 1, 2, 3, 4, 8 and 9.

Table I

Serial no.	Age	Halibut liver (*g*)	I.U. vit. A/100 ml serum 25.2.69	20.3.69	Headache	Nausea	Vomiting	Desquamation face	Desquamation trunk	Desquamation hands	Desquamation feet	Ambulant	To bed	Part. ambulant, part. to bed
1	23	300	355	310	+++	+	−	+	+	+++	+++	−	+	−
2	30	250	250	225	++	+	−	+	−	−	−	−	−	+
3	54	150	225	225	++	−	−	+	−	−	−	+	−	−
4	32	50	255	350	++	−	−	+	−	++	+++	−	−	+
5	28	20	250		+	±	−	+	−	−	−	+	−	−
6	61	90	190		+	±	−	+	−	−	−	+	−	−
7	20	300	175		+++	++	++	+	+	+	+	−	+	−
8	25	200	155	135	++	+	+	+	+	+	+	−	+	−
9	31	50	120	155	+	−	−	−	−	−	−	+	−	−
10	46	150	195		++	++	++	+	+	+	+	−	+	−
11	45	20	180		+	−	−	−	−	−	−	+	−	−

COMMENT

In the English translation of the diary of Gerrit de Veer (20), which describes the winter of 1596/1597 spent on the island of Nova Zemlya by a group of Dutch sailors led by Willem Barentsz and J. van Heemskerk, who were in search of the Northeast passage to India, the following passage is found on May 31, 1597. It concerns the shooting of a polar bear: "but her death did us more hurt than her life, for after we ript her belly, we drest her liver and eate it, which in the taste liked us well, but it made us all sicke, specially three that were exceeding sicke, and we verily thought that we should have lost them, for all their skins came of, from the foote to the head, but yet they recovered againe, for which we gave God heartis thankes". In the following centuries many whalers and arctic travelers became unpleasantly acquainted with the poisonous qualities of the livers of polar bear (3, 7, 8, 12, 19), and less frequently of eskimo husky (12, 18), bearded seal and greenland fox (18). Several cases of poisoning by fishliver have been recorded. Poslavski (15) described 9 patients who became ill after eating whale liver. Lonie (10) reported intoxication symptoms in a family after the ingestion of shark liver. Similar symptoms have been recorded after the eating of liver of "hapuka" (groper), kingfish, swordfish (8), ishinagi [stereolepis ishinagi (1)], Spanish mackerel (13), and red steenbras (16).

The symptoms of vitamin A intoxication were divided by Knudson (9), into those of acute and chronic intoxications, each occurring in children and adults. We shall limit ourselves to the acute intoxications in adults.

The following symptoms have been described regularly (3, 9, 10, 12, 15). Two to eight hours after the meal a very severe headache occurs, which is usually localized frontally, followed by nausea, vomiting, dizzyness, irritability tachycardia, a feeling of tiredness and an excessive urge to sleep (sometimes for 24 hours!). In the more severe cases there is redness of the face and sometimes of the mucous membranes. Usually there is localized or generalized pruritus. This is followed after 24–36 hours by peeling of the skin beginning around the mouth and spreading over the entire body. The skin of hands and feet sometimes comes off as a whole. Subconjunctival hemorrhages and gingivitis may occur. Usually the symptoms wear off in a few days, sometimes recovery takes longer. The desquamation lasts for several weeks. The symptoms in our patients are quite similar to those described in the literature of patients suffering from acute vitamin A intoxication after eating liver of polar bears, eskimo huskies, certain fish and after the ingestion of high dosages of vitamin A preparations (6). The patient reported in this paper had eaten halibut liver at other occasions without becoming ill. Fridtjof Nansen (14) reports eating polar bear liver in small amounts without ill effect. These observations may be explained by one of the following findings:

1. The concentration of vitamin A in halibut liver oil increases with the size of the liver and therefore with the size of the animal (11). In contrast to mammals, fish may continue to grow after reaching full maturity. As a result some fish in certain species may reach a very large size and weight. With increasing age the accumulation of vitamin A in the liver continues, since only small amounts of this vitamin are required.

2. There is a marked seasonal fluctuation in the vitamin A content of halibut liver mils. It may vary from 8000 i.u./g i February to 106,000 i.u./g in May (11). There is also a seasonal fluctuation in the amount of oil present in the liver. In general there seems to be an inverse relationship between the amount of oil in the liver and the vitamin concentration in the oil.

3. The part of the liver which is eaten may also play a role. The top of the liver lobe of the halibut contains the largest amount of vitamin A (2).

4. Finally the amount of liver eaten may have influence on the symptoms. It can be seen from Table I, that even small amounts of liver eaten have caused symptoms. If we take 100,000 i.u./g vitamin A as probable concentration (11) for this very large halibut liver, the ingestion of 20 g would be equivalent to a dose of 2 million units. Gerber considers this a sufficiently high dose to cause acute symptoms (4). Poslavski's patients developed symptoms exactly similar to those of our patients on dosages of 1–5 million units. It can be seen from Table I, that there is no relationship between the amount of liver eaten, the seriousness of the symptoms, and the serum vitamin A level, which is also in agreement with findings in the literature (6).

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