

# Protection from phototoxic injury during laparoscopic surgery in patients with erythropoietic protoporphyria

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## Abstract

*Erythropoietic protoporphyria is a hereditary defect in heme synthesis, causing protoporphyrin deposition and phototoxic reactions after exposure to light, especially at a wavelength of about 400 nm. Sensitivity to light may cause postoperative complications. Therefore, in open surgery protective filters are employed on surgical luminaires. The dangers of laparoscopy are little understood and the intensity of the light used can be high. To protect against phototoxic injury, we inserted an OG 530 filter in the video track. This filter blocks wavelengths below 470 nm. Three cholecystectomies and one sigmoidectomies were performed laparoscopically. The procedures were uneventful, and the patients suffered no adverse reactions, including phototoxic symptoms. The filter had a moderate influence on color perception and caused no significant restrictions on working conditions. We consider that it is appropriate to develop a relevant design to meet the suitable requirements for a durable filter holder in the laparoscopic video track.*

**Key words:** erythropoietic protoporphyria, surgical procedures, protection from phototoxic injuries, OG 530 filter.

Erythropoietic protoporphyria (EPP), is a rare, congenital autosomal dominant disease caused by an inherited gene mutation and low amounts of the enzyme ferrochelatase, which leads to a defect in heme synthesis and accumulate protoporphyrin mainly in red blood cells, plasma cells and bones marrow. Protoporphyrin is also stored in the liver and excreted to the bile. The accumulation of protoporphyrin is harmful and causes several health disorders. The frequency of EPP is estimated at 1 in 70,000 to 250,000 people. Nevertheless, patients with EPP, as well as the general population, may require surgery for other medical conditions. However, the typical and main symptoms of EPP are photosensitivity and phototoxicity to intense light, predominantly in the blue-violet region around 400 nm. Under intense light within the skin there are typical

skin syndromes (so-called painful sensitivity to sunlight) such as stinging sensation, redness, swelling or even ulceration.

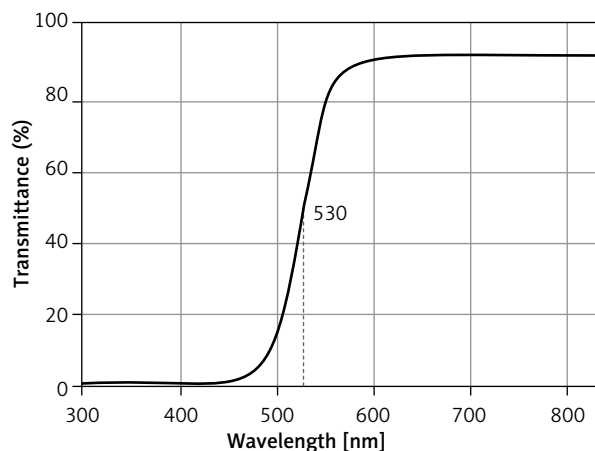
It is caused by the nature of protoporphyrin – a substance which absorbs sunlight or electric light in the light wave spectrum from 320 to 595 nm. After light energy absorption, protoporphyrin degenerates and releases free radicals causing a phototoxic injury to either skin or abdominal organs [1–3].

Certain publications and case reports confirm that high intensity operating lights are hazardous in EPP and cause many postoperative complications such as multiple intestinal perforations, biliary fistulation, duodenal ulceration, severe burns to the abdominal or skin necrosis [4].

Therefore, in order to protect from phototoxic injuries, in patients with EPP who require surgical pro-

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**Figure 1.** Transmittance spectrum for the OG 530 filter. The spectrum was obtained on a Thermo Fisher Scientific UV-VIS Evolution 220 spectrophotometer

cedures, protective filters are used to eliminate the most harmful wavelengths in the blue-violet range from the surgical lights [3, 5].

In open surgical procedures, especially in a liver transplantation, factory-made filters are used and are imposed in operating lamp binding and work well. On the other hand, we could not find such filters for laparoscopic procedures. That is why we devised the proper shape and size filter, OG 530, which guarantees photoprotection (Figure 1). We used it in the visual track of the Olympus mark in a junction between the optical fiber and the camera. At the beginning it did not work because it was impossible to join the rifled part of the camera and the optical fiber. We solved the problem by using a medical adhesive tape which ensured a proper and stable junction between the camera and the optical fiber. Due to this solution we operated on three patients without any complications. Laparoscopically, two cholecystectomies were performed due to cholelithiasis and one sigmoidectomy because of large bowel cancer. The filter had a moderate influence on color perception and caused no significant restrictions on working conditions. The surgeons did not consider visibility or working conditions significantly impaired when they worked under the filter. In the postoperative period, no symptoms related to phototoxic injury were observed. That is why we consider it appropriate to develop a relevant design to meet the suitable requirements for a durable filter holder in the laparoscopic video track.

## Conflict of interest

The authors declare no conflict of interest.

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