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Laser vaporization of inoperable esophageal and rectal cancer. Why we use this therapy

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Abstract: Laser therapy of esophageal or rectal cancer gives opportunity to withdraw temporarily symptoms of dysphagia or obstruction due to immediate vaporization of exophytic part of neoplastic tumor and exfoliation of coagulated deeper tissue. This therapy improves life comfort of patients suffering from esophageal and rectal cancer in cases when radical therapy is impossible. 58 laser vaporization of esophageal cancer in inoperable patients with ASA IV and V were performed from January 2008 to October 2011. 42 suffered from squamous-cell cancer, 16 – from esophageal adenocarcinoma localized endoscopically from 20 to 40 cm, administering 2 – 9 kJ of heat. Also 18 laser vaporisations of rectal cancer were performed, administering 4 - 18 kJ of heat. 1,6 sessions (1-5 sessions) with high-energy laser were performed on average, adjusting laser power for 70 W and performing photo-destruction of the esophageal neoplastic tumor with mortality of 2%. The average for rectal cancer were 1,1 sessions (1-2) with time asymptomatic of subileus from 8 to 33 months, mortality 5,5%. Laser vaporisation of gastrointestinal tract lesions is: 1. Alternative action in relation to other procedures regarding restoration of patency of the esophagus and the rectum in inoperable patients; 2. It is distinguished by short hospitalization time and low complications rate.

Keywords: Esophageal Cancer, Rectal Cancer, Laser Vaporisation

1. Introduction

1138 patients became ill from esophageal cancer, but 5338 patients became ill from rectal cancer in Poland in 2008 [1]. Some group of patients during disease diagnosis due to concomitant circulatory-respiratory burdens are inoperable patients and this fact significantly limits possibility of medical aid. The application of laser vaporization provides greater life comfort for patients with neoplastic disease in comparison with esophageal and rectal stents. Even in cases of incurable cancer, patients can swallow or defecate via natural ways.

Zittel's criteria proposed in 1994 are still relevant to use laser therapy:

1. Local inoperability: Tumor spread >8 cm, Infiltration of adjacent organs (T4), Previous operations in the upper GI tract
2. General inoperability: Age, Tumor cachexia, Secondary diseases Secondary tumors, Metastasis (M1).

Endoscopic interventions can be applied with good effect during the present age to improve quality of life regarding patients with esophageal and rectal cancer. The discussion still concerns whether to use endoscopic stents implantations, to restore patency with laser or to apply combined techniques of laser vaporisation with stenting. Decision of procedure that needs to be used, should be individually well-matched for situation and patient's state. Use of radiotherapy after laser vaporisation improves palliative effect of laser light for neoplasmatic tissue.

Laser vaporisation of neoplastic lesions is used as palliative procedure in esophageal, colon and rectal cancers with use of endoscope, colonoscope or operative rectoscope. High-energy neodymium-doped yttrium aluminium garnet lasers (Nd:YAG) are applied for these aims. These lasers use action based on old-established resonance phenomenon and forced emission discovered in 1917 by Albert Einstein. We

meet the notion of laser very frequently. The elaboration of meaning LASER - Light Amplification by Stimulated Emission of Radiation, it means light enhancement by forced radiation emission.

Lasers used in medicine were contractually divided into high-energy, it means surgical and low-energy. Lasers in surgery are used in sets assigned to destruct or remove tissues through cut, vaporisation or coagulation [2]. Low-energy lasers are applied in dermatology, rheumatology and dentistry.

The beam of laser light during contact with tissue causes its vaporisation or coagulation (coagulation of tissue protein). Effect of laser action on tissues is called photothermolysis. It allows to remove superficial lesions precisely – verrucas, granulomas, nodules. Thermal energy released in tissues plays essential role in case of lesions located within deeper layers. The wide regulation range of laser beam allows to apply very precisely from brush to deep ablation. Heat zones during action of laser light on soft tissues comprise within the range from 45 to $>200^0$ C, but penetration deep into Nd-Yag laser light < 4 mm.

Laser vaporisation of esophageal cancer regardless of tumor histological type is a palliative action. Technical success is obtained in 90 %, but functional success in 70-80 %. Perforation constitutes one of most often complications that occur in 2-5 %, but perioperative mortality reaches 1 %. ¼ of patients after laser vaporisation need another session due to dysphagia recurrence.

Laser vaporisation of rectal cancer is also a palliative action, preventing from ileus or bleeding. Total symptoms withdrawal is observed in 89 %. Perforation and bleeding are numbered as main complications (5,3 %). Mortality caused by perforation reaches about 1,8% [3]. Mean survival time noted in literature after application of laser vaporisation of inoperable rectal cancer is 8,5 months (0,6 – 52 months). The number of procedures that should be performed in case of neoplasm localised in the rectum amounts from 1 to 12 with asymptomatic time of 2 – 18 months [4].

2. Materials et Methods

58 laser vaporization of esophageal cancer in inoperable patients with ASA IV and V were performed from January 2008 to October 2011 in the Department of Gastrointestinal Tract Surgery of the Medical University of Silesia in Katowice. 42 patients suffered from squamous-cell cancer, 16 – from esophageal adenocarcinoma localized endoscopically from 20 to 40 cm. Patients' mean age was 78 years (42 – 83 years). Depending on the size of esophageal cancer, thermal energy from 2000 to 9000 was applied after placing endoscope over the lesion in the esophagus. Laser fibre installed through working channel of endoscope was used to transmit laser light.

18 laser vaporisations of rectal cancer of adenocarcinoma histological type were performed during described period of time. Mean age of this group of patients was 79 years (69 – 84 years). ASA was defined by anaesthesiologist as IV or V. Laser fibre-optic cable installed either through working channel of colonoscope or through operative rectoscope, was used to apply heat in amount from 4000 to 18000 J.

3. Results

Selected patients with inoperable esophageal cancer, qualified for therapy with laser vaporisation underwent 1,6 sessions (1-5 sessions) on average, using high-energy laser, adjusting laser power as 70 W and performing photodestruction of neoplastic tumor. Concerning observed complications, one (2%) patient after fourth session of laser vaporization revealed fistula into the bronchial tree. One patient showed stomach perforation due to excessive insuflation during laser therapy. Overall mortality was 2% (1/51). The estimation of survival time after described type of procedure was performed, using Kaplan-Meier method (Figure 1).

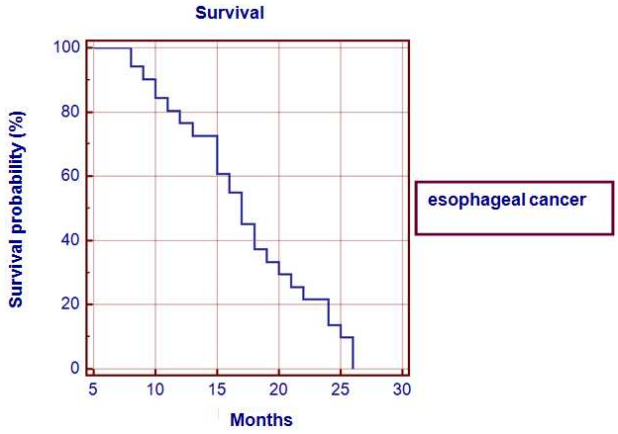
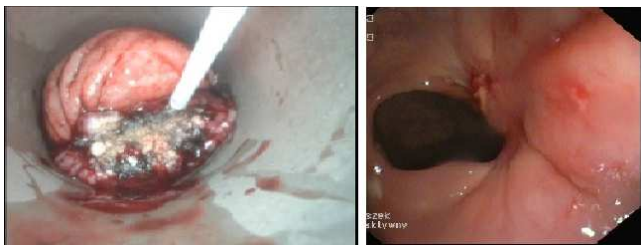


Fig. 1. *Kaplan-Meier estimators of patients after laser vaporisation of esophageal cancer.*

The patients, in whom laser therapy of rectal cancer was applied, the average number of sessions reached 1,1 (1-2) with time asymptomatic in the field of subileus from 8 to 33 months (Figure 2).



a b

Fig. 2. *a – Laser vaporisation of rectal cancer with use of operative rectoscope, b – Image of region of rectal tumor (1 month after laser vaporisation).*

The complication of laser vaporization of rectal cancer was obstruction caused by synchronic rectal and sigmoid cancer (1 case 5,5%). Overall perioperative mortality was 5,5%.

Survival time of patients after procedure of laser vaporisation of rectal cancer was presented on Figure 3.

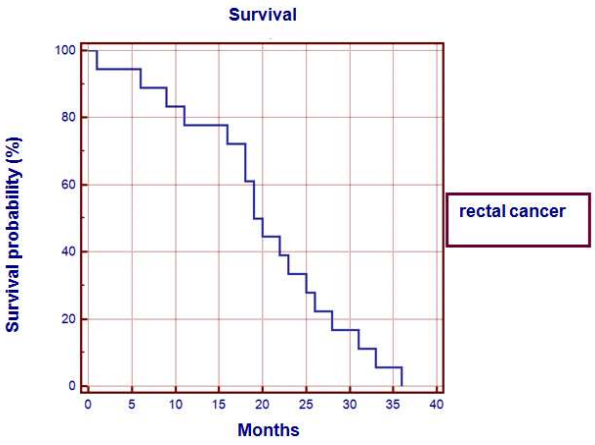


Fig. 3. *Kaplan-Meier estimators of patients after laser vaporisation of rectal cancer.*

4. Discussion

5-year survival in esophageal cancer is placed low and amounts to <20% [1]. Palliative procedures in case of esophageal cancer are currently: self-expanding stent implantation, laser vaporization, photodynamic therapy, systemic chemotherapy, external rtg-therapy, brachytherapy or combined chemo-radiotherapy [5]. There are inoperable patients in the group of patients with rectal cancer, in whom use of high-energy laser is an effective management to diminish constipations, bleedings or ileus [6].

The first endoscopic laser vaporisation of esophageal cancer was performed in 1982. Only a few centres have been applied this palliative method regarding esophageal and rectal cancer for this time. Laser therapy in the esophagus is used in case of cancer involving from 3 to 7 cm in length, applying from 1000 to 22600 J for one session. The authors of this study applied laser vaporisation in patients with esophageal cancer on the length from 1,5 to 5 cm, applying from 2000 to 9000 J of thermal energy. The energy amount needed for cancer vaporisation depends on lesion extension. The best effects are obtained when the tumor grows egzophytically into the esophagus lumen in the form of prominent "outgrowths", because vaporisation of such tumor is simpler and more effective. Laser therapy as one session is sufficient in majority of cases. Laser vaporisation provides fast effects due to fast destruction of neoplastic outgrowths and exfoliation of coagulated area for several days.

Laser is a dangerous device that requires deliberation and accuracy to administer beam on sick tissue. Incompetent management can result in burning the hole in the gastrointestinal lumen or endoscope damage, in case of tumors localised for example in subcardial region. Laser vaporisation of esophageal cancer gives possibility for inoperable patients to feed via natural way even though that is a palliative action [7, 8, 9, 10]. Use of laser vaporisation does not exclude application of self-expanding stents. Complications after stent use comprise within limits from 23 to 44%, but complications after laser vaporisation of esophageal cancer reach 5%.

According to our opinion, use of stent after laser vaporisation can not be successful without complication caused by stent migration. When neoplasmatic tumor is subjected to laser beam action, apart from fast vaporisation of tumor part, irreversible protein denaturation occurs in tissues that are situated in deeper layers and these tissues will peel off after several days, broadening the diameter of tubular organ. That is why stent implantation immediately after laser procedure regarding vaporisation of tubular organ cancer always results in stent migration.

Application of laser energy in the rectum is a simpler action than in the esophagus, because rectal lumen below neoplasic stricture is substantially wider than in the esophagus. That is the reason why manipulation with instruments is more convenient. The incidence of complications described as perforation or haemorrhage is low and it is running at 5% with mortality of 1,8%. Described method in relation to patients with high risk of perioperative death is a safe method [11]. The percentage of complication in our centre is comparable with described in the literature and reaches 5,5 %.

5. Conclusions

Analyzing available literature and considering own experiences with laser vaporisation of neoplastic lesions of the gastrointestinal tract the following conclusions were drawn.

Laser vaporisation of gastrointestinal tract lesions is:

1. Alternative action in relation to other procedures regarding restoration of patency of the esophagus and the rectum in inoperable patients
2. It is distinguished by short hospitalization time and low complications rate

Contributorship

The idea and project of the study: Paweł Lampe, Leszek Stefanski

Patients qualification: Pawel Lampe, Leszek Stefanski

Performance of laser vaporisation procedures: Leszek Stefanski

Analysis and data interpretation: Leszek Stefanski, Pawel Lampe

Manuscript writing: Leszek Stefanski, Pawel Lampe

Final manuscript approval: Leszek Stefanski, Pawel Lampe

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