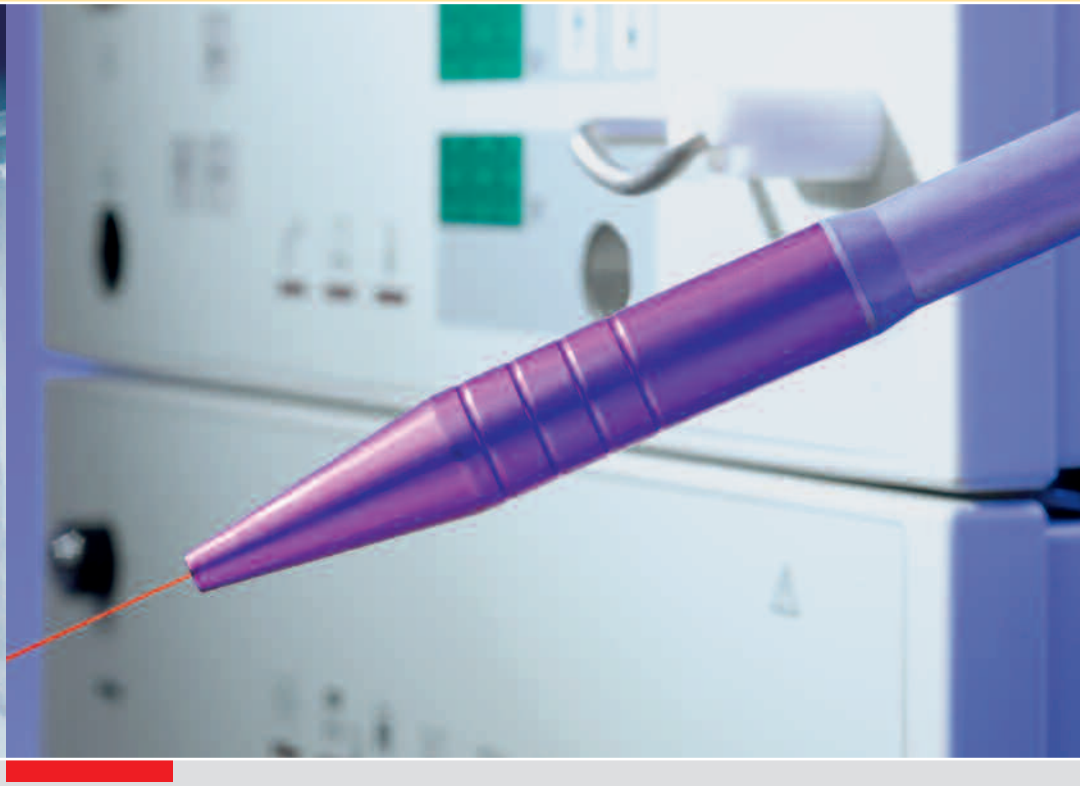
Laser



KLS Martin Nd:YAG-Laser MY 40 1.3

UNIQUE EXPERTISE IN
PULMONARY PARENCHYMA SURGERY

KLS martin
GROUP

KLS Martin Nd:YAG-Laser MY 40 1.3

Cancer – the word still has a devastating ring for patients when first confronted with the diagnosis. While it is true that in the past decades great progress has been made in the treatment of cancer, there is still the risk of a metastatic spread once the disease is under control or has been totally eliminated by appropriate therapies – particularly in the liver, lung or brain. The problem is that these organs consist of parenchymal tissue and therefore are difficult to operate. Thanks to a novel laser unit, it is now possible to treat lung metastases with outstanding success. The advantage of this innovative method is that only the affected metastatic tissue is actually removed with the laser, whereas conventional techniques require the excision of entire lung segments.

Introduction

Since KLS Martin launched its MY 40 Nd:YAG laser back in 1999, thoracic surgeons have, for the first time, a laser at their fingertips that fully meets the special requirements demanded by this surgical field. Thanks to its special wavelength of 1,318 nm, which is characterized by a ten-fold higher absorption in water, the MY 40 laser ideally combines resection, coagulation and tissue sealing for effective control of the two greatest risks or problem factors posed by interventions on the lung parenchyma – blood loss and air loss – to a previously unattainable degree.

In the course of the past years, this surgical technique has been gaining wide acceptance, especially in the field of metastatic surgery. Thanks to a significant parenchyma- and lobe-sparing effect, especially in the resection of multiple metastases, plus a correspondingly lower lobectomy rate, the MY 40 laser offers patients new perspectives, enabling them to retain a high quality of life. In addition, there are – besides medical advantages – numerous economic aspects that speak for this new therapeutic approach, e.g. savings in costly consumables such as stapler magazines and fibrin glues.

In Germany alone, more than 40 thoracosurgical centers are currently working with this innovative laser. Besides, a strongly increasing interest in this surgical technique can be observed in neighboring countries as well. Trailblazing reference centers have already been established in Austria, Switzerland, Italy, France, Poland and Russia. Thanks to the development of extremely thin quartz fibers, the MY 40 laser can also be used very successfully in thoracoscopy as well as in endotracheal and endobronchial lung surgery.

To provide users with the basic and specialized knowledge they need for this surgical technique, KLS Martin – in collaboration with its clinical partners – offers special laser workshops (Basic and Specialized Training Courses) designed to address both the theoretical and the practical challenges involved. Apart from the laser-surgical basics, these workshops focus on practical issues and experiences gained with the MY 40 laser. We will be glad to inform you about the workshops

Contents:

Innovative Laser Technique for Metastatic Surgery
3 Case Examples* ..... Page 4-7

Theory and Practice
The Biophysical Foundations of the MY 40 1.3 Laser ..... Page 8

All Advantages at a Glance ..... Page 9

Information & More
Technical Data and Ordering Numbers ..... Pages 10+11

Extremely High Power Density
The Focusing Handpiece ..... Pages 12+13

Small yet Efficient
The Gas Flow Controller ..... Page 14

A Global Success Story
References ..... Page 15

* By courtesy of Fachkrankenhaus Coswig GmbH

Case 1:

Laser resection of a centrally located metastasis

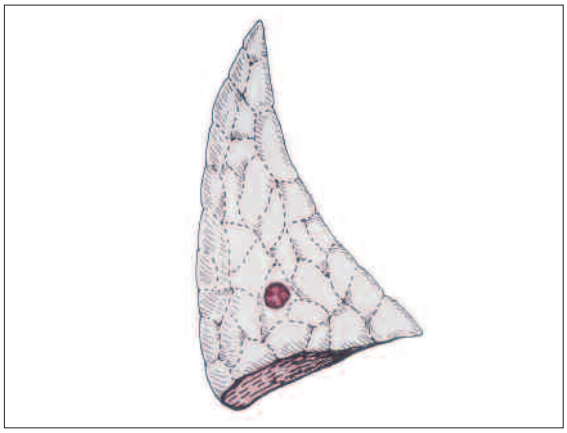


Fig. 1a: Sketch of the lower lobe with the metastasis located right in the center, in a place where the lobe is thickest.

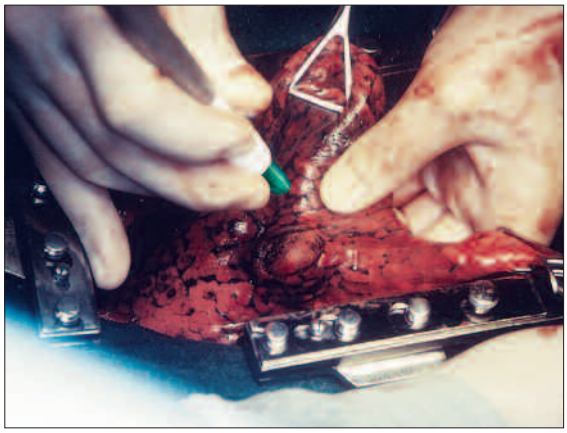


Fig. 1b: Preparing the resection, using the laser to expose the central metastasis. The middle and index fingers support the deflated lung, holding the tumor towards the dissecting laser beam. Thanks to the absence of hemorrhages, the surgeon has an excellent view of the surgical field.

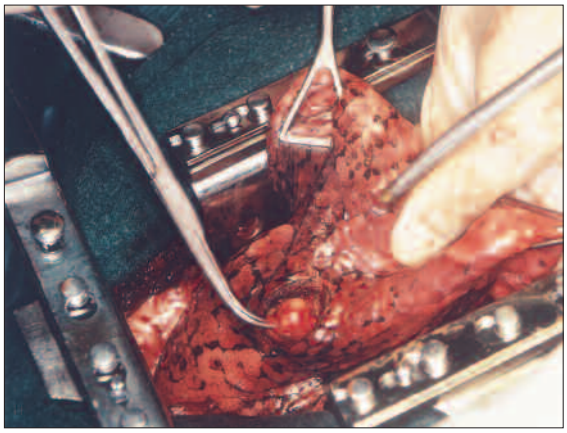


Fig. 1c: The central tumor is clearly visible and easily accessible. It can now be cut out by hemorrhage-free “precision resection”, ensuring a safety margin of approx. 1 cm all-around.

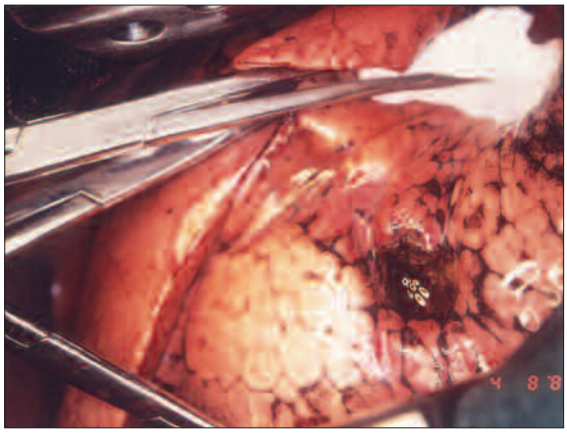


Fig. 1d: Here is the final result. The metastasis has been removed and the lower lobe reinflated. The underwater test demonstrates the absence of fistulas and air leaks. The result is a completely expanded lower lobe. The only lung tissue lost is that of the dissection canal and the tumor itself (incl. the safety margin).

Case 2:

Lobe-sparing laser resection of difficult-to-access multiple metastases located in one lobe

This case shows the resection of altogether six metastases of a chondrosarcoma located in the shoulder of a 44-year-old male patient. The metastases have a size of 2–3 cm and are all sited in the left upper lobe, either peripherally, centrally or adjacent to the hilum. All metastases were removed with the laser, leaving the function of the upper lobe nonetheless fully intact.

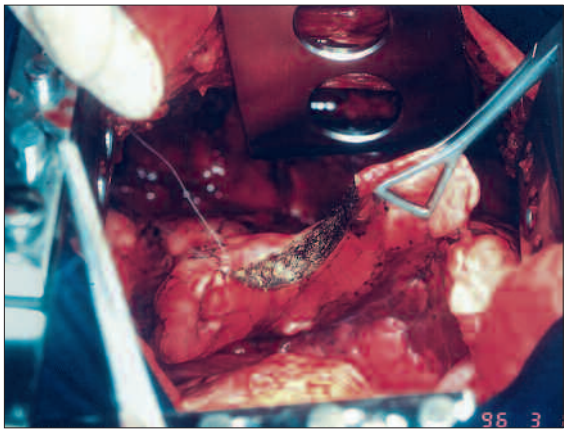


Fig. 2a: Resection of the first peripheral metastasis having a diameter of 2.5 cm. Another metastasis, 3 cm large and located centrally near the hilum, can already be seen underneath.

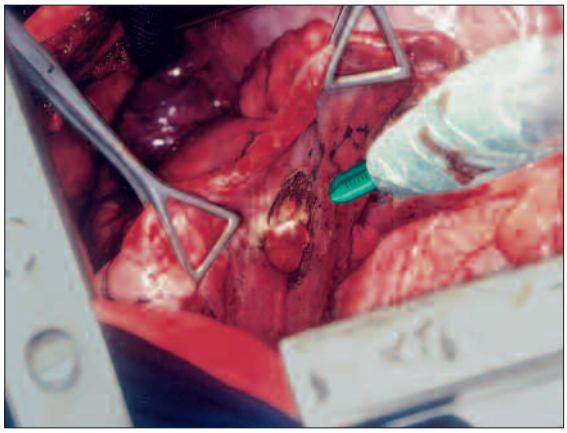


Fig. 2b: Another metastasis (2 cm large), located next to the hilum and adjacent to the pericardium, is being removed with the laser.

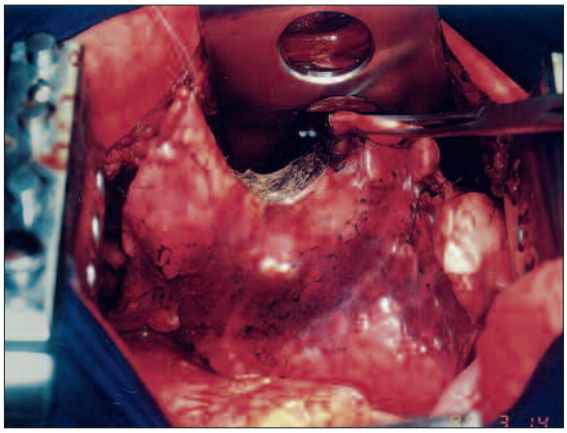


Fig. 2c: Another metastasis with a diameter of 3 cm, located in the center of the upper lobe. As can be seen from the continuous suture of the visceral pleura, a metastasis has already been removed in the upper right corner.

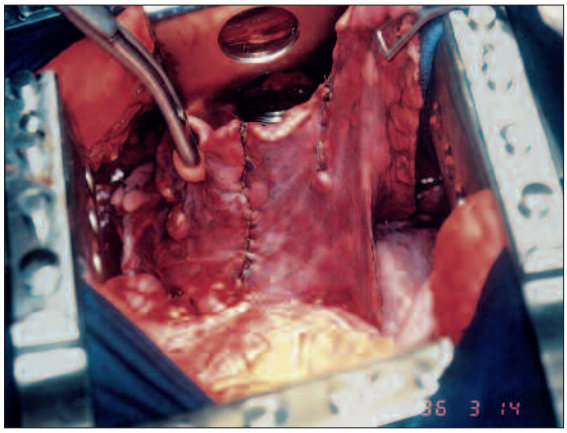


Fig. 2d: Result after laser resection of six metastases. You can see the various adaptation sutures of the visceral pleura that reconstruct the surface of the left upper lobe. Thus, both the shape and the function of the upper lobe can be preserved.

Case 3:

Laser resection of a large metastasis extending to the trunk of the lower lobe artery

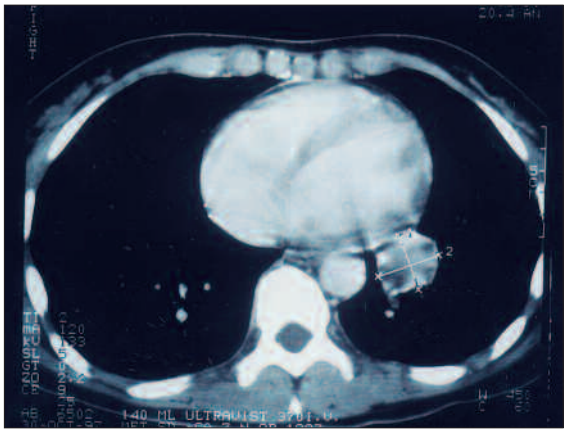


Fig. 3a: CT image of a 44-year-old female patient with a 6-cm metastasis in the left lower lobe, contiguous to the pericardium.

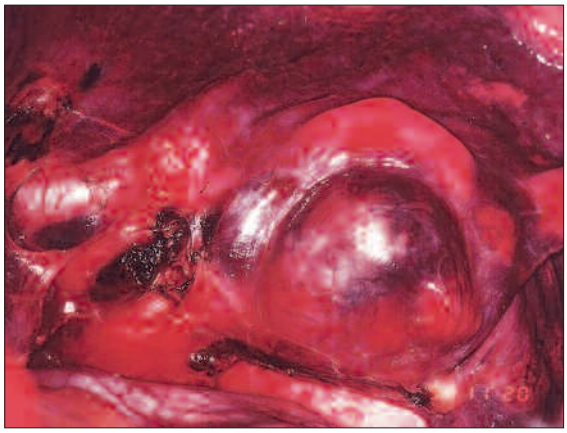


Fig. 3b: Intraoperative findings: You can see the large metastasis contiguous to the pericardium but not infiltrating it. In the left middle section, the trunk of the pulmonary artery of the lower lobe is visible, being in immediate contact with the tumor. In such advanced cases, the standard conventional treatment option would be lobectomy.

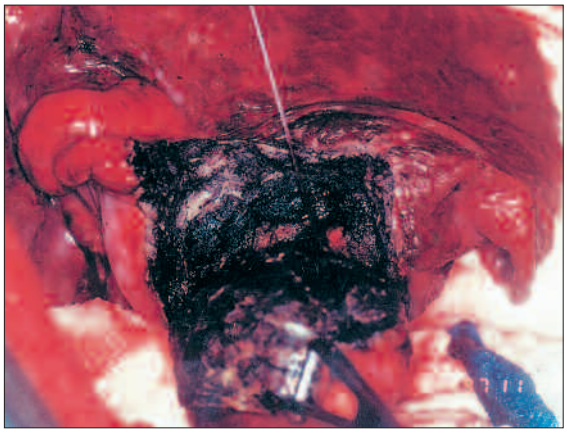


Fig. 3c: Laser resection of this large metastasis located immediately next to the pulmonary artery. The tumor is being held aside in the lower section of the photograph.
In the center of the picture, you can see a Vicryl thread leading to the segmental-artery and segmental-bronchus suture that can also be recognized.

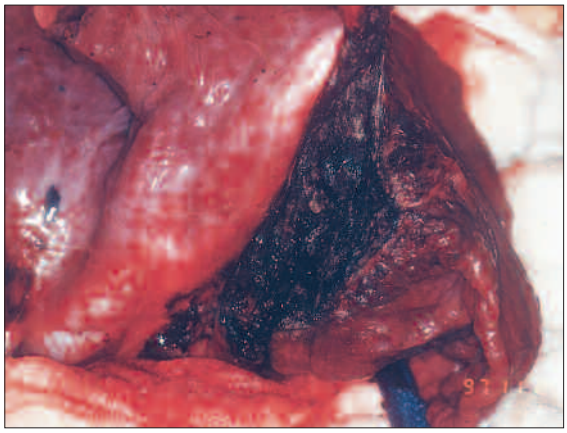


Fig. 3d: Laser resection surface following removal of the metastasis. The entire surface is completely hemorrhage-free. The resection was performed on the completely deflated lower lobe, as still indicated by its dark appearance.

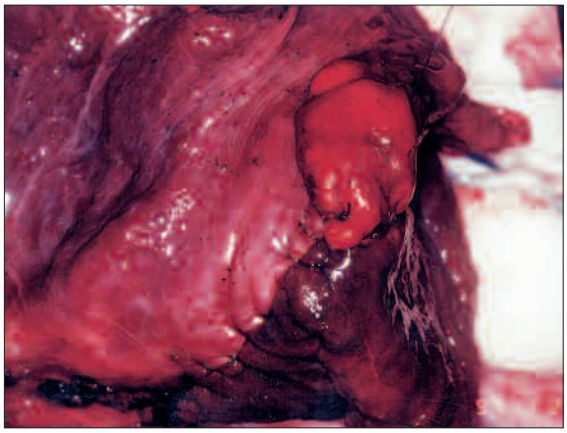


Fig. 3e: Re-adaptation of the lower lobe by a continuous suture of the visceral pleura. Note again the main artery of the lower lobe, visible in the lower left corner.

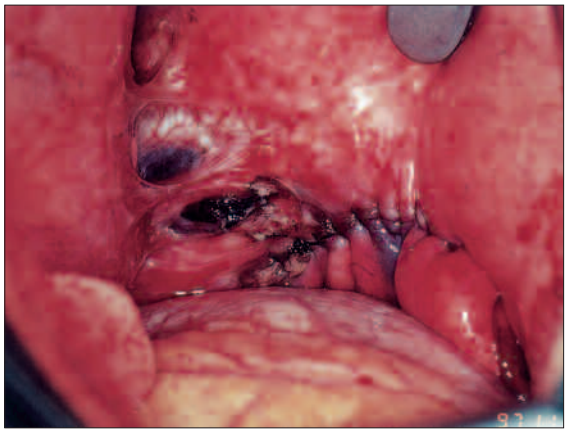


Fig. 3f: Condition after intraoperative re-inflation of the lower lobe. As can be seen, re-inflation is complete despite extensive parenchyma resection.

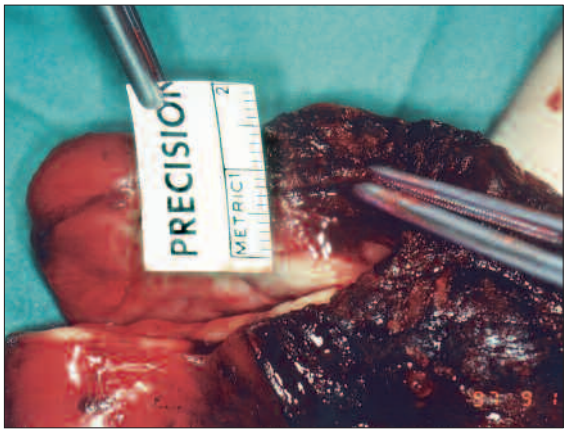


Fig. 3g: The resected metastasis, 6 cm in diameter, as a preparation. It was removed by way of a so-called "precision resection" with a safety margin of 1 cm, which is considered oncologically sufficient for metastases.

Fig. 3h: The final x-ray, taken shortly before the patient was sent home. The anteroaxillary thoracotomy performed on both lungs removed a total of 10 metastases, ranging between 2 and 6 cm in size. Both lungs are completely expanded. 18 months later, there are still no signs of a recurrence. Lung function is 102% of the age-adjusted standard value.

The Biophysical Foundations of the MY 40 1.3 Laser

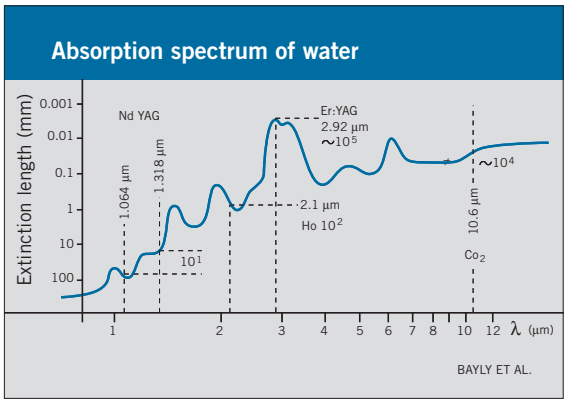


Fig. 4: Simplified schematic of the absorption spectrum of water (acc. to BAYLY et al.). Note the 1,064-nm and 1,318-nm wavelengths of the Nd:YAG laser which have been specially added.

As can be seen, there is a sudden tenfold increase in absorption at 1,318 nm, which accounts for the superior coagulation and cutting properties of this wavelength.

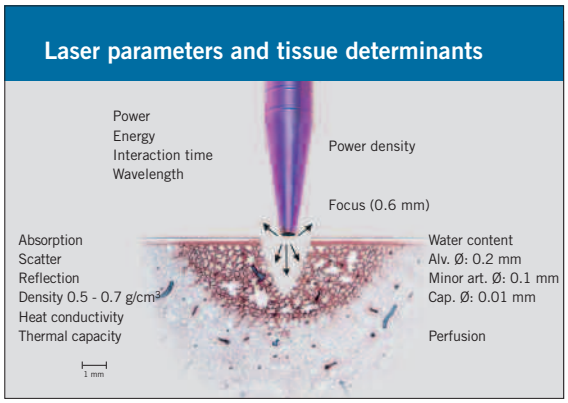


Fig. 5: This schematic shows important laser parameters and tissue determinants. You can see a laser beam with a focus of 600 µm set in relation to the anatomical parameters of lung parenchyma. Crucial tissue determinants are the low density of the lung tissue (0.15 g/cm³), its high water content (80%) and its high shrinking capacity that is due to the air content of the alveoli.

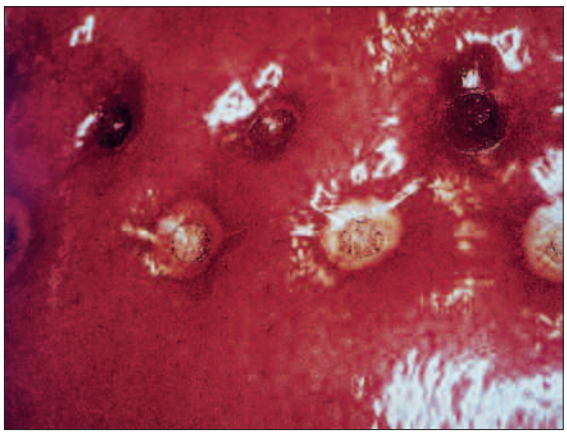


Fig. 6: A series of irradiation craters in lung tissue. The wavelength-specific differences are macroscopically visible. The upper row shows three craters caused by irradiation with the 1,064-nm laser at 30 W for 1 s. Two zones can be distinguished: The vaporization crater in the center, and a surrounding hyperemic zone of small hemorrhages. The crater itself also exhibits small hemorrhages. Lower row: Craters after irradiation with a 1,318-nm laser at 15 W (= half power) for 1 s. Three zones can be distinguished here: The vaporization crater in the center, then a wide, whitish coagulation zone surrounding it, finally a hyperemic margin.

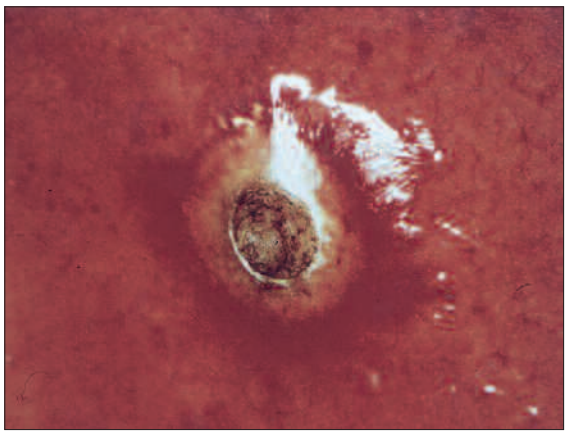


Fig. 7: Individual irradiation crater created by a 1,318-nm Nd:YAG laser at 20 W/1 s. This magnified picture clearly shows the three-zone structure (as explained in Fig. 6).

All Advantages at a Glance:

Clinical advantages for metastatic surgery:

- A large number of metastases (>150) can be removed, ranging in size from a rice grain to a tennis ball
- Deep-seated metastases and tumors can be exposed and resected while preserving the affected segment or lobe
- Flexible, yet mechanically strong coagulation zones allow for surgical suturing of the visceral pleura as an additional safety measure
- Dry (hemorrhage-free) and fistula-tight resection surfaces
- Intervention can be repeated if recurrences occur
- Significantly higher life expectancy with almost no loss of quality of life

Economic advantages:

- Savings in expensive consumables (e.g. stapler magazines, fibrin glues)
- Extended interdisciplinary indications in open thoracic surgery, thoracoscopy and endobronchial surgery, therefore more patients can be treated
- The MY 40 1.3 enables the inclusion of patients that were previously considered “inoperable”
- Enhanced hospital reputation due to use of innovative laser technology and advanced methods

Application examples for open thoracic surgery:

- **Metastatic surgery**
- Parenchymal bridge transection
- Pulmonary vesicle resection
- Open pulmonary biopsies
- Removal of benign tumors
- Bronchial carcinoma operations
- Surgical techniques available: Enucleation, wedge resection, lobectomy, typical and atypical segmental resections, bisegmentectomy (plus a combination of any of these procedures)

Application examples for thoracoscopic surgery (VATS)

- Pulmonary vesicle ablation and thermal pleurectomies in cases of spontaneous pneumothorax
- Air vesicle ablation in pulmonary emphysema cases
- General hemostasis and fistula sealing
- Removal and enucleation of pleuropulmonary coin lesions (malignant and benign tumors)
- Partial resection of lung tissue
- Recurring pneumothorax
- Adhesiolysis
- Pleurodesis (various causes)

Application examples for endobronchial surgery:

- Tumor ablation
- Stenosis removal
- Vaporization of pathologic tissue
- Hemostasis

Stand-alone version

KLS Martin MY 40 1.3 laser – the extremely compact and mobile Nd:YAG laser for multi-disciplinary use

"Eco" stand-alone version

KLS Martin MY 40 1.3 eco laser – the special Nd:YAG laser model for connection to a 230-VAC (50/60 Hz) supply source max. output limited to 36 W

Separate version

KLS Martin MY 40 1.3 laser with separate installation of laser head and supply unit

The compact laser head is ideally suited for installation on the platform of a ceiling-mounted supply-and-suspension unit. The laser head/supply unit separation facilitates compliance with the most stringent hygiene requirements and also minimizes the space requirements for the laser unit in the OR. The laser operates noise-free, thus preventing stress for the OR team.

More flexibility and freedom of movement around the OR table!

Available MY 40 1.3 laser systems

79-040-10	Stand-alone version
79-040-11	"Eco" stand-alone version
79-040-15	Separate version

Scope of delivery of the KLS Martin MY 40 1.3 laser

	Stand-alone version	Separate version
Laser head	✓	✓
Supply unit	✓	✓
Foot switch, 2-stage	✓	✓
Flyer and support bracket	+	+
Deionization cartridge	✓	✓
Potential equalization lead	✓	✓
2 laser warning signs	✓	✓
Supply lead	–	✓

+ Optional accessory (to be ordered separately!)

Technical Data

KLS Martin MY 40 1.3 and KLS Martin MY 40 1.3 eco

Laser type
Continuous-wave Nd:YAG laser, 1,318 nm (infrared)
Protection class: I
Laser class: IV
Type of protection: IP X1

Output power (MY 40)
0.5 - 40 W

Output power (MY 40 eco)
0.5 - 36 W

Operating modes
• continuous-wave (cw)
• pulsed — *Time increments:*
- single pulse — *0.1 s between 0.1 and 1.0 s*; *1 s between 1 and 10 s*
- pulse train — *0.1 s between 0.1 and 1.0 s*; *1 s between 1 and 10 s*

Pilot laser
635 nm (light-red)
1 mW, continuous-wave; adjustable to 5 mW, continuous-wave

Control and monitoring
Microprocessor

Display
LED, green, contrast-optimized

Control panel
Soft-touch panel with wipable surface

Cooling
Air-cooled, closed water circuit
Cooling agent: water (15 l, distilled, deionized)

Optical fiber connection
SMAplus (modified SMA) connector
Laser NA: ≤ 0.2
Focus Ø: ≤ 260 µm

Laser fibers
Quartz fibers, low-OH^-, NA > 0.2
260-µm core diameter
400-µm core diameter
600-µm core diameter
400-µm core diameter, gas-irrigated

Dimensions (W x D x H) and weights
Laser head: 406 x 460 x 135 mm
Weight: 12 kg
Supply unit: 406 x 460 x 775 mm
Weight: 61 kg

Electrical connection (MY 40)
380 VAC, 3~, 3 x 10 A, 50/60 Hz,
CEE 16 A

Electrical connection (MY 40 eco)
230 VAC, 50/60 Hz

Approval/mark of conformity
CE 0297, in compliance with 93/42/EEC

Ordering Data

Standard Equipment

Qty	Item No.	Designation
1	79-040-10-04	MY 40 Nd:YAG laser, 40 W, 380 VAC*
4	79-100-50-04	Laser protective goggles
4	79-100-51-04	Laser protective goggles for persons wearing spectacles
1	78-201-00-04	Focusing handpiece, basic body
2	78-202-30-09	Front sleeve, short, green, for 78-201-00
2	78-210-30-04	Front lens, green, f = 30 mm, for 78-201-00
2	79-301-40-04	Fiber for focusing handpiece, for MY 40 1.3 laser
1	78-231-00-04	MY GAS 2 gas flow controller
1	83-100-30-04	Silicone hose (MY GAS 2 connection to fiber)
1	78-215-01-04	Pressure hose (MY GAS 2 connection to central gas supply)
1		"AtmoSafe" OR smoke evacuator, complete
*** Alternatively:**		
1	79-041-10-04	MY 40 eco Nd:YAG laser, 36 W, 230 VAC
Alternative when using gas cylinders:		
1	79-060-91-04	Pressure reducer set, DIN 477 thread = W 21.8 x 1/14" rh, Dräger system (other systems on request)

Optional Accessories

Item No.	Designation
79-100-50-04	D 1000-1400 L6 RH DIN CE laser protective goggles acc. to 89/686/EEC (PPE)
79-100-51-04	D 1000-1400 L6 RH DIN CE laser protective goggles for spectacle-wearers, acc. to 89/686/EEC (PPE)
78-201-00-04	Focusing handpiece, basic body, for threaded sleeves
78-201-01-04	Focusing handpiece, basic body, for push-on sleeves
78-202-30-09	Front sleeve, short, green, threaded, for 78-201-00-04
78-202-31-04	Front sleeve, short, green, push-on
78-202-50-09	Front sleeve, long, lilac, threaded, for 78-201-00-04
78-202-51-04	Front sleeve, long, lilac, push-on
78-210-30-04	Front lens, green, f = 30 mm, for 78-201-00-04 and 78-201-01-04
78-210-50-04	Front lens, lilac, f = 50 mm, for 78-201-00-04 and 78-201-01-04
78-222-00-04	Adapter for push-on front sleeves (retrofit for 78-201-00-04; already incl. in 78-201-01-04)
78-231-00-04	MY GAS 2 gas flow controller with connecting cable for MY 40 1.3, incl. gas cylinder adapter with safety valve; working and base gas flows can be set independently, for use with gas-irrigated fibers and focusing handpieces
83-100-30-04	Silicone hose (for connecting MY GAS 2 to fiber)
79-060-91-04	Pressure reducer set incl. 2-m pressure hose
78-215-01-04	Pressure hose for connecting MY GAS 2 to central gas supply
79-120-00-04	Flyer
79-121-00-04	Retaining arm
78-216-01-04	Extension cable, CEE 16 A, 380 VAC, 5 m
78-216-02-04	Reducer, CEE 32 A to CEE 16 A

Accessories for Thoracoscopy and Endobronchial Surgery

Item No.	Designation
79-111-00-04	Fiber preparation set, complete, autoclavable, with 260/400/600-µm fiber stripper, silicone mat and fiber knife (can be used only for bare fibers)
79-340-26-04	Flexible quartz fiber, 260-µm bare fiber, 3 m, pack of 5, for thoracoscopy
79-340-40-04	Flexible quartz fiber, 400-µm bare fiber, 3 m, pack of 5, for thoracoscopy and endobronchial surgery
79-340-60-04	Flexible quartz fiber, 600-µm bare fiber, 3 m, pack of 5, for thoracoscopy and endobronchial surgery
79-345-30-04	Gas-irrigated fiber, 3 m, pack of 5, for endobronchial surgery and thoracoscopy

79-111-00

79-120-00

79-121-00

79-340-26
79-340-40
79-340-60 (not illustrated)

79-345-30

The KLS Martin MY 40 1.3 Laser Makes it Possible:

Effective cutting, vaporization, coagulation and sealing on a non-contact basis and without any need to exchange instruments. To make use of different focal distances, you simply need to exchange the front lens.

Thanks to the high-transmitting laser fibers and one of the best laser focusing handpieces available on the market, extremely high power densities can be achieved in the focus of the beam.

The power density is extremely uniform across the entire beam focus profile (Ø 0.6 mm)

Features of the KLS Martin Focusing Handpiece for MY 40 1.3 Nd:YAG Lasers

To make the Nd:YAG laser light available for surgical use, we developed a top-notch optical system based on high-quality materials. **This achieves exceptionally high power densities in the beam focus when using the handpiece in conjunction with a KLS Martin Nd:YAG laser and the 400-µm fiber.** When applied to physiological tissue, this system impresses by its outstanding "non-contact" cutting, vaporization and coagulation properties.

The gas flow on the handpiece and along the fiber has been optimized as well. This ensures excellent gas irrigation efficiency unrivaled in this product class. The gas flow keeps the beam path free from absorbing particles (such as smoke/plume and tissue debris) between the focusing handpiece and the tissue. This also reliably prevents focusing lens contamination.

Two focal distances – 30 mm and 50 mm – are available to users. Along with the different front sleeves, this permits optimal adaptation of the system to the surgical task at hand. Thanks to the modular design of the handpiece, changing the focal length is a matter of seconds – you simply exchange the front lens. In addition, different front sleeves allow you to use different working distances.

As the beam profile shows, power density is extremely uniform across the entire surface of the beam focus.

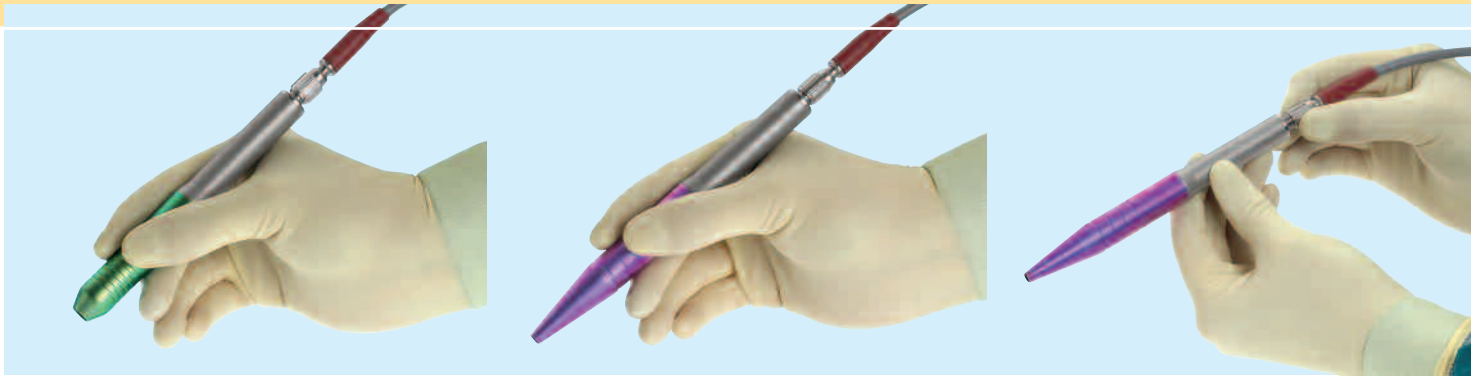
The well-thought-out service concept – notably the quick-action connector that permits easy connection of the fiber to the handpiece, plus the easily exchangeable front lens – optimizes the availability of this instrument in daily clinical use – especially as any such exchange can be conveniently performed by the user him/herself whenever the need arises during operations.

Focusing handpiece power densities

Laser fiber Ø (µm)	Focusing handpiece focal length (mm)	Power density kW/cm² Focus Ø (µm)	Laser power (W) 20	30	40
400	30	590	7.3	11.0	14.6
400	50	900	3.1	4.7	6.3

Focusing handpiece with threaded sleeve

Focusing handpiece with push-on sleeve



Depending on the lens-sleeve combination used (note the color-coding), different working distances are obtained as specified in the table.

Sleeve	Front/focusing lens	Working distance
short, green	30 mm, green	12 mm
long, lilac	50 mm, lilac	12 mm
short, green	50 mm, lilac	35 mm

Focusing handpiece

Item no.	Designation
78-201-00-04	Basic body for threaded sleeves for focusing handpiece
78-201-01-04	Basic body for push-on sleeves for focusing handpiece
78-202-30-09	Front sleeve, short, green, threaded, for 78-201-00-04
78-202-31-04	Front sleeve, short, green, push-on
78-202-50-09	Front sleeve, long, lilac, threaded, for 78-201-00-04
78-202-51-04	Front sleeve, long, lilac, push-on
78-210-30-04	Front lens, green, f = 30 mm, for 78-201-00-04 and 78-201-01-04
78-210-50-04	Front lens, lilac, f = 50 mm, for 78-201-00-04 and 78-201-01-04
78-222-00-04	Adapter for push-on front sleeves, for retrofitting 78-201-00-04 to 78-201-01-04 (already included in 78-201-01-04)
80-181-90-04	Sterile filter for MY 40

KLS Martin MY GAS 2 Gas Flow Controller

In conjunction with the MY 40 1.3 laser unit, the KLS Martin MY GAS 2 gas flow controller ensures constant and controllable irrigation gas consumption during laser application.

The gas flow is controlled via the two-stage laser foot switch. Both the working gas flow and the base gas flow can be set independently.

The underside of the MY GAS 2 gas flow controller features a magnetic foil that keeps it securely in place and prevents it from slipping off the laser unit.

If You Need More Information ...

… please let us know. We'll be glad to send you our comprehensive CD-ROM and/or any of the reference documents indicated below.

MY 40 Nd:YAG laser references

- Laser Applications in Lung Parenchyma,
  90-193-02-04 (in English), 2003
- Lobe-Sparing Resection of Multiple Pulmonary Metastases with a New 1318-nm Nd:YAG Laser – The First 100 Patients,
  90-150-02-04 (in English), 2002
- Surgical Palliation in the Thoracic Region in Cases of Primary and Secondary Malignant Tumors,
  90-109-01-04 (German) and
  90-109-02-04 (English), 2001
- Innovation in der Lungenchirurgie – Laser bei Lungenmetastasen,
  90-284-01-04 (in German), 2005
- Laser Resection Technique and Results of Multiple Lung Metastasectomies using a new 1,318 nm Nd:YAG Laser System
  90-296-02-04 (English), 2006

KLS Martin Subsidiaries

KLS Martin France SARL
3, Rue Gambetta
68000 Colmar
Frankreich/France
Phone +33 3 89 21 66 01
Fax +33 3 89 23 65 14
axel.siegelin@klsmartin.com

Martin Nederland / Marned B.V.
Vissersstraat 9a
1271 VE Huizen
P.O. Box 278
1270 AG Huizen
Niederlande / The Netherlands
Phone +31 3 55 23 45 38
Fax +31 3 55 23 53 48
info@martinnederland.nl

KLS Martin L.P.
11239-1 St. John`s Industrial
Parkway South
Jacksonville, Fl 32246
USA
Office phone 904 641 77 46
Office fax 904 641 73 78
Toll free 800 625 15 57
sburke@klsmartin.com
www.klsmartinusa.com

Martin Italia S.r.l.
Via Paracelso, 18
Palazzo Andromeda, Ingresso 2
20041 Agrate-Brianza (Mi)
Italien / Italy
Phone +39 3 96 05 67 31
Fax +39 3 96 05 67 42
info@martinitalia.it

Nippon Martin K.K.
6 Fl., 4-6-16 Hiranomachi
541-0046 Chuo-ku,
Osaka 541-0046
Japan
Phone +81 6 62 28 90 75
Fax +81 6 62 28 90 76
info@n-martin.com

Gebrüder Martin GmbH & Co. KG
A company of the KLS Martin Group
Ludwigstaler Str. 132 · D-78532 Tuttlingen
Postfach 60 · D-78501 Tuttlingen
Tel. +49 7461 706-0 · Fax +49 7461 706-193
info@klsmartin.com · www.klsmartin.com