Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Treatment of Lymph Fistula after Vascular Surgery with Low-Dose Radiotherapy

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Purpose/Objective(s): After vascular reconstructions in the groin area, a persistent lymph fistula regularly threatens the prognosis of the affected extremity. Rapid, effective treatment of the lymph fistula is therefore essential in order to be able to prevent amputation. As part of a pilot study, we wanted to analyze the chances and limitations of radiotherapy in the treatment of lymphatic fistulas.

Materials/Methods: As part of an internal quality control, patients were identified for this study who acquired a lymph fistula in the groin as a result of vascular surgery due to *peripheral artery disease* stage IV and were irradiated at the University Hospital Düsseldorf.

Results: Eight men aged 66 + 12, 4 years underwent vascular surgery for PAD stage IV. Surgery was performed in these patients via the groin and all men subsequently had a persistent lymphatic fistula with a secretion greater than 50 ml/day. Five patients were irradiated with a fractionation of 10×0.4 Gy and 3 patients with a fractionation of 10×0.3 Gy. In all patients, the lymphatic fistula dried up within the irradiation series. No higher-grade complications occurred.

Conclusion: Irradiation of the groin in the case of a persistent lymphatic fistula could be a therapeutic option to avoid amputations due to wound infections after vascular reconstruction in the groin. Prospective randomized studies would be desirable in order to be able to better evaluate the role of radiotherapy in the treatment of lymphatic fistulas.

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Radiotherapy for Ledderhose Disease: A Prospective, Multicenter, Randomized, Double-Blind, Phase III Trial (NCT03507010)

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Purpose/Objective(s): Radiotherapy is considered a treatment option for Ledderhose disease. However, the added value of radiation has never been confirmed in a randomized controlled trial (RCT). The objective of this study was to test the hypothesis that radiotherapy significantly improves outcome in terms of symptom relief and quality of life in patients with Ledderhose disease as compared to sham-radiotherapy.

Materials/Methods: The LedRad-study is a prospective, multicenter, randomized, double-blind, phase III trial comparing radiotherapy to sham-radiotherapy (placebo), as treatment for patients with symptomatic Ledderhose disease. The main inclusion criteria were pain from Ledderhose disease (≥ 2 on the numeric rating scale (NRS)), no previous surgery and/or radiotherapy to the affected foot, and age ≥ 18 years. Stratification factors were age and gender. Radiotherapy consisted of 10 fractions of 3 Gy administered in two separate courses of five daily fractions, with an interval of 10 weeks. Procedures in both groups were identical, except that treatment delivery was simulated for the patients in the sham-radiotherapy arm. Unblinding of the treatment was performed 18 months after the end of (sham-)radiotherapy. The primary endpoint was pain reduction at 12 months after treatment, measured with the NRS. Secondary endpoints were pain reduction at 6 and 18 months after treatment, quality of life (QoL), walking abilities and safety/toxicity.

Results: From January 2018 to October 2019, 84 patients (27 men and 57 women) were included in this study. Mean age at randomization was 56 years (SD 9 years). A total of 130 feet were treated; 65 in each group. Patients in the radiotherapy group had significantly lower mean pain scores compared to patients in the sham-radiotherapy group at 12 and 18 months after the study treatment (p=0.03 and p=0.01 respectively). Pain relief (cumulative complete and partial pain response) at 12 months was 74% for the radiotherapy group and 56% for the sham-radiotherapy group (p=0.002). At twelve months after the end of study-treatment QoL scores in the radiotherapy group improved and were comparable to the score of the Dutch general population. Multilevel testing for QoL scores showed significantly higher QoL scores for the radiotherapy group compared to the sham-radiotherapy group (p<0.001). Moreover, patients from the radiotherapy group had a significantly higher mean walking speed and step rate when walking fast on bare feet (p=0.02). No safety issues related to radiotherapy occurred during and after treatment.

Conclusion: The LedRad-study showed that radiotherapy for symptomatic Ledderhose disease is an effective treatment which results in a significant pain reduction and an improvement of QoL scores and walking abilities, as compared to sham-radiotherapy.

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Low Dose Radiotherapy in the Management of COVID-19 Pneumonia (LOWRAD-Cov19): Final Results

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Purpose/Objective(s): To evaluate the results of LD-RT to lungs in the management of patients with COVID-19 pneumonia.

Materials/Methods: We conducted a prospective phase I-II trial enrolling COVID-19 patients ≥50 years-old, with bilateral lung involvement at imaging study and oxygen requirement. Patients received 1 Gy to whole lungs in a single fraction. Primary outcome was radiological response assessed as severity and extension scores at days +3 and +7. Secondary outcomes were toxicity (CTCAE v5.0), days of hospitalization, changes in inflammatory blood parameters (ferritin, lymphocytes, C-reactive protein, d-dimer and LDH) and SatO2/ FiO2 index (SAFI), at day +3 and +7. Descriptive analyses were summarized as means with standard deviation (SD) and/or medians with interquartile ranges (IQR). A Wilcoxon sign rank test for paired data was used to assess the CT scores and Chi Square was used to assess for comparison of categorical variables.

Results: Forty-one patients were included. Median age was 71 (IQR 60-84). Eighteen patients (47%) previously received any antiCOVID treatment (tocilizumab, lopinavir/ritonavir, remdesivir) and thirty-two patients (84%) received steroids during LD-RT. Extension score improved significantly (p=0.02) on day +7 and SAFI on day +3 and + 7 (p<0.01). Median SAFI on

day 0 was 147 (IQR 118-264), 230 (IQR 120-343) on day +3 and 293 (IQR 121-353) on day +7. Significant decrease was found in C-reactive protein on day +7 (p=0.02) and in lymphocytes counts on day +3 and +7 (p=0.02). Median number of days in hospital after RT was 11 (range 4-78). With a median follow-up of 60 days after LD-RT, 26 (63%) patients were discharged, 11 (27%) died because of COVID respiratory failure and 4 (10%) died of other causes.

Conclusion: LD-RT is a feasible and well-tolerated treatment that may lead to rapid clinical improvement. Large randomized trials should be done to establish the efficacy of LD-RT to treat COVID-19 pneumonia.

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Treatment of Dupuytren's Disease with Post-Interventional Radiotherapy

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Purpose/Objective(s): Ongoing clinical studies are currently testing the benefit of radiotherapy (RT) in Dupuytren Disease (DD) early after interventions used to release a contracture in order to reduce the chances of re-contracture and prevent non-operated areas forming new contractures. Those interventions are needle fasciotomy (NF), collagenase injection (CI) and limited fasciectomy (LF). This phase I-II study summarizes patients with advanced DD treated between 2005 - 2020 using post-interventional RT with follow-up of at least 1 year (mean 5.5, range 1 − 15 years).

Materials/Methods: Patients underwent RT at four different practices organized by a single radiation oncologist (HS) and were divided in two groups: Group A: Early post-interventional RT (given 2-12 weeks after intervention) A1, post-NF: n=25 patients, Male: Female ratio = 15:8; age range 38−73y, 29 hands treated A2, post-CI: n=7: M: F = 4:3, age 41−74y, total 7 hands A3, post-LF: n=19: M: F = 11:8, age 35-71y, total 19 hands Group B: Delayed post-interventional RT (given 4 to 48 months after intervention) B, delayed RT: n=48, M: F = 30:18, age 31−76, total 53 hands All groups received two series of 15Gy in daily fractions of 5 × 3Gy with a 10-12 weeks interval up to 30Gy total dose in 10 fractions. All groups apart from group A3 received RT in two RT-series to the whole palm for both phases while in group A3 the 2nd RT series excluded the LF site. RT Timing: In groups A1 and A2, RT was started 2-4 weeks after intervention. In group A3 RT was started 6-12 weeks after intervention after local healing was completed. In group B, RT was started at least 4 months after intervention. The international "DD progression" criterion was used and defined as increased angulation deficit of at least 20 degrees in any of the involved fingers. Proven progression was categorized as either within or outside the previously operated area.

Results: Long-term functional stability w/o progression was evaluated in 12-2020 and achieved in 83% of Group A1 hands, in 57% of group A2, 90% in group A3, and 86% hands in group B. Minor progression with functional change of up to 10 degrees after RT occurred in 32/108 (30%) and up to 20 degrees in 15/108 (14%) hands. Symptoms such as pain, burning and itching were reduced in 57 of 73 (78%) affected pts. Cosmetic and functional outcome were judged to be "excellent" in 26 (24%), "good" in 38 (35%), "satisfactory" in 17 (16%) and "poor" or "unsatisfactory" in 27 (25%) sites. RT Side effects were long-term dryness in 43 of 108 (40%) sites; no deep wounds or ulcers or post-interventional infections were observed.

Conclusion: This is the first clinical study published demonstrating that post-interventional RT is an effective and safe addition to minimal non-invasive (NF and CI) and limited invasive (PNF) procedures to preserve improvements in hand function after intervention. Further controlled clinical studies supported by IORBC are required to optimize RT indication, specific selection criteria, interdisciplinary collaboration and applied RT dose concepts.

Author Disclosure: R. Shaffer: Consultant; GenesisCare, Xstrahl Ltd. Lead for benign radiotherapy; GenesisCare UK. H. Seegenschmiedt: Chair; German benign radiotherapy group.

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Low-Dose Radiation Therapy for COVID-19 Pneumonia: Comparison of Dosimetry with Conventional AP-PA Fields and Bone Marrow Sparing VMAT

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Purpose/Objective(s): Low-dose radiation therapy (LDRT) to lungs has shown encouraging results in COVID-19 patients in some clinical trials. However, there has been some concern regarding the long-term risk of radiation induced cancer (RIC). Compared to conventional AP-PA field technique, volumetric modulated arc therapy (VMAT) can potentially reduce the dose to marrow and other organs-at-risk (OARs) and thus minimize the risk of cancer. We designed a dosimetry study to study if VMAT can reduce the exposure to marrow and other OARs.

Materials/Methods: We retrieved the CT scan data of 10 patients (aged 40-60 years) who have been already treated for any malignancy in the region of thorax. A dose of 1.0 Gy in single fraction was prescribed to both lungs. All the organs were delineated as per the established guidelines. The dosimetry achieved by the two plans (conventional AP-PA field technique and VMAT) were compared to find the difference.

Results: PTV coverage parameters like conformity index (CI) and homogeneity index (HI) were significantly better with VMAT (p value <0.05 for all). As shown in Table 1, Mean dose to most OARs was significantly lower with VMAT (p value <0.05 for all). Mean dose to marrow was significantly lower with VMAT (59.05 vs 81.9 cGy with p value <0.05).

Conclusion: Compared to conventional technique, VMAT provides better OAR dosimetry for lung irradiation (prescription dose of 1.0 Gy or more) in COVID-19 pneumonia. We therefore suggest, if lung LDRT is used for COVID-19 patients, VMAT as the preferred technique for a prescription dose of ≥1.0 Gy.

Abstract 2946 - Table 1: Comparison of OAR doses with conventional and VMAT plan

OAR	Conventional		VMAT		p value
	Median (cGy)	Range (cGy)	Median (cGy)	Range (cGy)	
Lung	109.2	106.8-114.5	102.2	99.5-104.1	0.075
Heart	105.3	103.8-109.6	73.9	61.2-85.9	<0.05
Spinal cord	76.6	54.3-98.6	34.2	24-54.6	<0.05
Marrow	81.9	52.5-104.3	59.05	37.5-70.7	<0.05
Skin	29.95	19.7-39.7	19.85	11.8-28.8	<0.05
Thyroid	58.6	12.3-83.7	24.95	13.0-55.6	<0.05
Esophagus	99.7	95.5-103.7	82.1	72.4-89.7	<0.05
Breast	80.2	75.8-87.2	67.6	58.2-72.8	<0.05

OAR = organ at risk; VMAT = volumetric modulated arc therapy

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Association Between Radiation Exposure and Family History of Cancer: Analysis of an Online Risk Assessment Tool

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