

# Intraoperative Indocyanine Green Fluorescence Angiography Decreases Postoperative Wound Complications in Soft Tissue Sarcoma Surgery

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## Introduction

Post-operative wound complications following resection of soft-tissue sarcomas are common, reported to occur in up to 30% of patients who receive preoperative radiation therapy.

Prior studies have reported on risk factors for wound complications and have attempted to mitigate these risks, but the overall complication rate remains largely unchanged.

What is needed is the ability to intraoperatively determine the tissue's capacity to heal in order to help reduce wound complications.

Indocyanine green (ICG) fluorescence angiography has previously been used to predict wound complications, but not for soft-tissue sarcomas. We adopted this technology in sarcoma surgery to evaluate if it could help lower postoperative wound complications.

## Methods

A prospective study was conducted from 10/2017 – 9/2019, using ICG angiography during sarcoma resection surgery.

Following wound closure the incision was evaluated using ICG angiography to evaluate areas of hypoperfusion.

Areas of hypoperfusion were then excised until only well-perfused tissue remained on subsequent scans

Rates of postoperative wound complications (defined as dehiscence and infection) were compared to historical controls consisting of surgeries prior to utilization of ICG angiography.

	Control		Fluorescence Angiography		P value
	N=71	81.0%	N=17	19.0%	
<b>Age (Mean ± SD)</b>	59.6	17.5	57.7	16.9	0.69
<b>Sex</b>					>0.99
Males	37	52.1%	9	52.9%	
Females	34	47.9%	8	47.1%	
<b>BMI (Mean ± SD)</b>	29.53	7.4	27.2	5.1	0.23
<b>Smoking</b>					0.62
No	39	54.9%	12	70.6%	
Yes	9	12.7%	1	5.9%	
Only past history	23	32.4%	4	23.5%	
<b>Steroids use</b>					0.59
No	65	91.5%	16	94.1%	
Yes	6	8.5%	1	5.9%	
<b>Diabetes</b>					0.38
No	62	87.3%	16	94.1%	
Yes	9	12.7%	1	5.9%	
<b>PVD</b>					<b>0.04</b>
No	69	97.2%	14	82.4%	
Yes	2	2.8%	3	17.6%	
<b>CAD</b>					0.42
No	58	81.7%	13	76.5%	
Yes	13	18.3%	4	23.5%	

Table I: Patient demographics compared to historical controls (Abbreviations: BMI, body mass index; PVD, peripheral vascular disease; CAD, coronary artery disease)

	Control		Fluorescence		P value
	N=71	81.0%	N=17	19.0%	
<b>Tumor location</b>					0.44
Upper extremity	14	19.7%	5	29.4%	
Lower extremity	45	63.4%	12	70.6%	
Thorax	6	8.5%	0	0.0%	
Pelvis/genitalia	6	8.5%	0	0.0%	
<b>Tumor size (cm)</b>					0.61
Mean ± SD	8.86	7.6	7.88	5.5	
<b>Radiotherapy</b>					0.07
No	26	36.6%	2	11.8%	
Yes	45	63.4%	15	88.2%	
<b>Chemotherapy</b>					0.62
No	50	70.4%	12	70.6%	
Yes	21	29.6%	5	29.4%	
<b>Closure</b>					0.17
Primary	33	46.5%	7	41.2%	
Local flap	26	36.6%	4	23.5%	
Free flap	7	9.9%	2	11.8%	
Skin graft	4	5.6%	3	17.6%	
Free flap and skin graft	1	1.4%	0	0.0%	
Local flap and skin graft	0	0.0%	1	5.9%	
<b>Infection</b>					<b>0.03</b>
No	44	62.0%	15	88.2%	
Yes	27	38.0%	2	11.8%	
<b>Wound dehiscence</b>					<b>0.02</b>
No	41	57.7%	15	88.2%	
Yes	30	42.3%	2	11.8%	

Table II: Tumor characteristics and postoperative complications

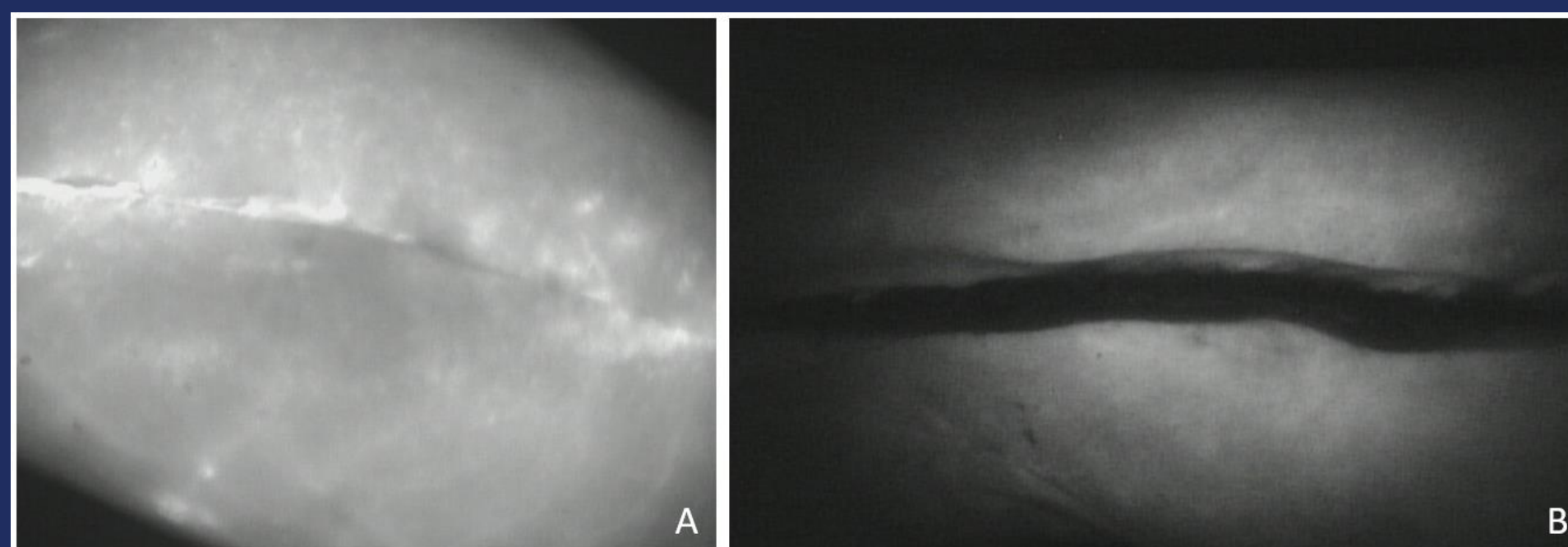


Figure 1: Intraoperative angiography images demonstrating adequate perfusion (A), and hypo-perfusion (B) along the incisions.

## Results

A total of 88 patients were included in the study. There were no major significant differences in demographics between the ICG cohort and historical controls (Table I)

Tumor characteristics and complications are listed in Table II. We found no significant differences between the cohorts.

Five patients (29.4%) in the ICG cohort demonstrated hypovascular tissue at the time of wound closure and underwent excision of this tissue; two of these patients developed a postoperative complication.

We found significantly lower rates of postoperative infection (11.8% versus 38%; p=0.03) and wound dehiscence (11.8% versus 42.3%; p = 0.02) in the ICG angiography cohort compared to the historical controls.

## Conclusion

We found statistically significant lower wound complication rates for infection and wound dehiscence following sarcoma resection when using intraoperative indocyanine green angiography.

This is promising technology and warrants further investigation to help reduce postoperative complications following soft tissue sarcoma resection.