Mark W. Clemens, MD FACS  
Associate Professor  
MD Anderson Cancer Center  
Kaiser Permanente  
2018 Plastic Surgery Symposium  
February 10, 2018

Disclosure  
None

TE Experience  
Infection

Univariate

BMI, p=0.04  
Age>52, p=0.05  
Comorbidity, p=0.02  
SN1bx, p=0.04  
High Intraop Hb, p=0.08

Multivariate

Postop XRT, p=0.02  
CA vs. Proph, p=0.08  
Duct vs Lob, p=0.004  
SN1bx, p=0.009  
Bra>700cc, p=0.003  
Surgical drain time, p=0.003

Immediate DIEP flap after XRT

- 42 year old female  
- Previous left breast IDC, lumpectomy  
- Mastopexy reconstruction  
- Left breast XRT

Radiation Sequelae

- Injurious effects of radiation therapy  
- Increased complications  
- Lower patient satisfaction with reconstruction  
- By BREAST-Q  
- Double major complication rate to non-radiated reconstruction  
- No radiation 24.4%  
- PMRT 45.4%  

MD Anderson TE Experience  
Overall Complications

Overall

N=564  
BMI, p=0.005  
Comorbidity, p=0.02  
Diabetes, p=0.13  
Invasive, p=0.07  
Duct vs Lob, p=0.004  
Bra>700cc, p=0.003  
NSM, p=0.002  
Postop XRT, p=0.003  
In situ vs. invasive, p=0.07  
Duct vs Lob, p=0.004  
Bra>700cc, p=0.003  
NSM, p=0.002  
Postop XRT, p=0.003

Univariate

BMI, p=0.005  
Comorbidity, p=0.02  
Diabetes, p=0.13  
Invasive, p=0.07  
Duct vs Lob, p=0.004  
Bra>700cc, p=0.003  
NSM, p=0.002  
Postop XRT, p=0.003

Multivariate

BMI, p=0.005  
Comorbidity, p=0.02  
Diabetes, p=0.13  
Invasive, p=0.07  
Duct vs Lob, p=0.004  
Bra>700cc, p=0.003  
NSM, p=0.002

Evidence

Mark W. Clemens, MD FACS  
Reconstruction  
2018

Comorbidity, p=0.02  
BMI, p=0.005  
Diabetes, p=0.13  
Invasive, p=0.07  
Duct vs Lob, p=0.004  
Bra>700cc, p=0.003  
NSM, p=0.002

Wren  
Comorbidity, p=0.02  
BMI, p=0.005  
Diabetes, p=0.13  
Invasive, p=0.07  
Duct vs Lob, p=0.004  
Bra>700cc, p=0.003  
NSM, p=0.002

Evidence

Mark W. Clemens, MD FACS  
Reconstruction  
2018

Comorbidity, p=0.02  
BMI, p=0.005  
Diabetes, p=0.13  
Invasive, p=0.07  
Duct vs Lob, p=0.004  
Bra>700cc, p=0.003  
NSM, p=0.002

Evidence

Mark W. Clemens, MD FACS  
Reconstruction  
2018

Comorbidity, p=0.02  
BMI, p=0.005  
Diabetes, p=0.13  
Invasive, p=0.07  
Duct vs Lob, p=0.004  
Bra>700cc, p=0.003  
NSM, p=0.002
Radiation Therapy Algorithm

- **Breast cancer**
  - Invasive
  - DCIS
  - Node Positive
  - Node Negative

- **Radiation**
- **Chemotherapy**

- **No Radiation**
- **25%**
- **75%**

- **Delayed Autologous reconstruction**
- **2 Stage Tissue Expander/Implant**
- **Immediate Autologous reconstruction**
- **2 Stage Tissue Expander/implant**

Chemotherapy Changing

- Neoadjuvant is standard of care
- All patients with >2cm breast cancer and LN involvement
- Substantially improves BCT rates
- Converts unresectable to operable
- Allows observation of chemo “responders”
- May obviate need for XRT and surgery


Not All Tissue Is Equal

- Parsa 2009:
  - Severe skin changes: 75% poor aesthetic outcomes
  - Induration: 100% poor aesthetic outcomes
  - Patients may be stratified as an acceptable prosthetic candidate based upon skin response
  - C509-T Variant in TGF-B promoter allele: 50% of the population, 4x fibrosis after radiation


C509-T Variant Predicts PMRT Fibrosis

- % Patients with Grade 2-3 Fibrosis
- % Patients with Moderate-to-Large Shoulder Stiffness (BCTOS)
- % Patients with Grade 2 Breast Atrophy

- Level II Evidence

Not All Radiation is Equal

- Two-angled (Tangential): Technically easiest for reconstructed shapes. Whole breast. Two phases. 50.4 Gy plus 10 Gy boost
- Multifield Approach (3-dimensional): More adaptable to varying anatomy. Always treats IMNs with less heart and less lung. Technically challenging. Requires flat anatomy or deflated expander.
- Intensity-modulated radiation therapy (IMRT) 6 field technique. Most uniform dose. Whole thorax dose is 10-20% including contralateral lung and contralateral breast. Complicated, time-intensive and costly

Incidence of IM Disease

- 1200 cases of Stage III Breast Cancer treated 1996-2006 at MDACC
- 865 had regional lymphatic involvement beyond the axilla: Infraclav, Supraclav, IMC
- 37% had clinically evident disease beyond the low axilla:
  - Infraclav: 32%
  - Supraclav: 16%
  - IMC: 11%

Benchmark Studies

IM Radiation
- MA-20: Nodal radiation benefits local recurrence in early stage breast cancer
- Improved survival hormone receptor-negative disease
- Disease-free survival were 82.0% in the nodal-irradiation group and 77.0% in the control group
- DBCG: Danish cohort on IM radiation in early stage node positive breast cancer
- Improved survival: 75.9% with IMNI versus 72.2% without IMNI

ADM as Radiation Protector?
- Higher complications
- Delayed integration
- Capsular contracture protective?
- BCT vs PMRT
- Implants vs. Autologous reconstruction

Timing of Complications
- 3 postoperative phases
- Pre/XRT/Post
- Majority of complications occur perioperatively
- Equal rates during and post radiation

ADM Protective for Explantation

- Non-ADM patients are significantly impacted by onset of PMRT, experiencing more explantations.
  - OR = 3.19, p = 0.002
- ADM patients are not impacted by PMRT, and may play a protective role.
  - OR = 0.38, p = 0.04
DTI in NSM Prosthetic Reconstruction

Previous RT

Three-week postop

Fat Grafting the Radiated Breast

- Hyperpigmentation, ulceration, and dermal thickness all improve in a radiation animal model\(^1\)
- Attenuates inflammation and slows progression of fibrosis\(^1\)
- Oncologically safe\(^2\)
  - Recurrence rate 5.3% compared to 4.7% control
- May require 10-40% overcorrection


Case Example: Prosthetic Reconstruction Radiated Breast

\(\text{41-year-Old Female: Invasive Ductal Carcinoma of the Left Breast}\)

\(\text{Fat grafting at exchange}\)

- 200cc Left
- 100cc Right
- 600cc round bilaterally

\(\text{ALND} \quad 9\text{ months post XRT}\)

\(\text{Fat grafting at exchange}\)

\(\text{ALND Scar & Axillary Scar} \quad 1\text{ year postop}\)

\(\text{Breast Scar} \quad 1\text{ month postop}\)
PrePectoral TE Placement

- Less postoperative pain
- No muscle distortion
- Temporary air filled TE

Delayed-Immediate to Prosthetic Timing of Exchange

- Nava et al. 2011
- 50 patients TE-XRT-Implant
- 109 patients TE-Implant-XRT
- Control: 98 Non-XRT
- All patients chemo postop

<table>
<thead>
<tr>
<th>TE-XRT</th>
<th>Imp-XRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure rates</td>
<td>40%</td>
</tr>
<tr>
<td>Cap rates</td>
<td>53.3%</td>
</tr>
<tr>
<td>&quot;Good results&quot;</td>
<td>30.8%</td>
</tr>
</tbody>
</table>


Timing of Radiation: Effect of PMRT

- Cordeiro 2015: TE-XRT versus implant-XRT

Timing of Radiation: Effect of PMRT

- Cordeiro 2015: TE-XRT versus implant-XRT
**Case Example: Delayed-Immediate TE to LD + Implant**

- 42 year old female with IDC of the right breast, Node+
- BMI 19
- Requires 3-beam radiation therapy with IM

**Stage 1:** Skin-Preserving Mastectomy
Subpectoral Tissue Expander

- Partial Deflation of Tissue Expander
- Radiation Therapy

**Stage 2:** Abdominally-Based Free flap Latissimus Dorsi Flap with Permanent Implant

**Example Case:**

**Robotic Assisted Latissimus Harvest**

- Begin in a lateral decubitus position on a beanbag
- Use previous mastectomy and/or axillary dissection scar
- Dissect out pedicle and lateral border of latissimus
  - 30% of superficial dissection
  - As much as possible deep dissection

**Notes:**

- Marionette sutures
- One 12 mm port for camera
- Two 8 mm ports:
  - Monopolar Maryland retractor dissector
  - Electrocautery scissors

---

**Robotic Assisted Latissimus Harvest**

- Begin in a lateral decubitus position on a beanbag
- Use previous mastectomy and/or axillary dissection scar
- Dissect out pedicle and lateral border of latissimus
  - 30% of superficial dissection
  - As much as possible deep dissection

**Notes:**

- Marionette sutures
- One 12 mm port for camera
- Two 8 mm ports:
  - Monopolar Maryland retractor dissector
  - Electrocautery scissors

---

**Robotic Assisted Latissimus Harvest**

- Begin in a lateral decubitus position on a beanbag
- Use previous mastectomy and/or axillary dissection scar
- Dissect out pedicle and lateral border of latissimus
  - 30% of superficial dissection
  - As much as possible deep dissection

**Notes:**

- Marionette sutures
- One 12 mm port for camera
- Two 8 mm ports:
  - Monopolar Maryland retractor dissector
  - Electrocautery scissors
**Technique: Conversion to Autologous**

- Inset of muscle over intended implant and/or sizer
- Total muscle coverage
- Shaped, high cohesive implants

**Example Case: Delayed-Immediate**

![One year postoperative](image1)

**Example Case: Delayed-Immediate**

![Two-year postoperative](image2)

**Fat Grafting with Robotic LD and Implant**

- Delayed-immediate XRT protocol
- ADM with tissue expander
- Robotic latissimus dorsi
- Fat grafting

**Case 2**

![30-month postop](image3)

**Pathway to Adding Robot Skills to Your Practice**

1. MD Anderson Visitor
2. Attend International Training Course - RAMSES
3. Engage Urology, Oncology, ENT for preceptorship
Predictors and Timing of Radiated Breast Reconstruction

Conclusions

• Blood test CS09-T Variant of TGF-B predicts fibrosis and reconstructive outcomes

• Prosthetic reconstruction of the radiated breast is more challenging, results in lower patient satisfaction, and is heavily dependent on radiation type and timing

• Improved aesthetic outcomes are possible combining technique advancements, ADM, fat grafting, and conversion to autologous when appropriate

mwclemsn@mdanderson.org
Twitter: @clemensmd