Tissue archiving: reality, recommendations, and best practices

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University Hospital of Montpellier, France
• Review tissue block archiving guidelines in the US and discuss how these regulations compare to those in other countries throughout Europe.

• Examine how one laboratory achieved time-savings while improving compliance with their tissue block archiving system.

• Identify best practices towards improving your laboratory’s efficiency in tissue block archiving.
Increased block volume:

- Cancer incidence
- Aging population
- Improvement of standards of care
- Legal retention period
Paraffin blocks management: main challenges

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- Aging population
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- Legal retention period

Need to manage the blocks:
- Advancement of personalized medicine
- Second opinion
- Research projects
- Clinical trials
Paraffin blocks management: main challenges

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- Aging population
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- Legal retention period

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...with shortage of technicians and lab resources
Agenda

• Part 1: Paraffin blocks archiving: legal, recommendations and facts:
  • 1 - identification
  • 2 - conditions of storage and retention period
  • 3 - retrieval tracking
  • 4 – long-term archiving economical issue

• Part 2: Evaluation of a new block management system
Part 1: Paraffin blocks archiving: legacy, recommendations and facts
1- Identification!
Patient misidentification in laboratory medicine?

- 253 root cause analysis reports from the Veterans Health administration, collected between 2000 and 2008
- Patient misidentification: 182 adverse events (72%)
- Stage of the test cycle:
  - 132 misidentification events occurred in the pre-analytic phase and
  - Only 37 events (20%) occurred in the analytic phase: 4 failure for cancer diagnosis
  - 13 in the post-analytic phase
- Manual entry and limiting the patient identifier to accession number contributed to specimen misidentification

Arch Pathol Lab Med 2010;134:244-255
Study of mislabeling of cases, specimens, blocks and slides in 136 institutions

- Participants prospectively reviewed surgical pathology cases for 8 weeks and identified all mislabeling errors
- 1811 mislabeling occurrences:
  - 0.11% Cases: (490 of 427,255)
  - 0.1% Specimens (796 of 774,373)
  - 0.17% Blocks (2,172 of 1,304,650)
  - 0.11% Slides (2,509 of 2,261,811)
- In 96.7% of cases, errors were corrected before reports were issued
- In 1.3% of errors occurrences, participants gauged that patient care was affected

Arch Pathol Lab Med 2011;135:969-974
Study of mislabeling of cases, specimens, blocks and slides in 136 institutions

• 3 points in the process must be tightly controlled:
  • Accessioning
  • Transferring tissue into blocks
  • Tissue cutting and slide mounting

• The mislabeling rate was lower in institutions that:
  • Used automatic labelers integrated with accessioning systems
  • had a continuous (one by one)individual-case accessioning and processing (Avoid batch work)

Arch Pathol Lab Med 2011;135:969-974
CAP guidelines: blocks must have TWO identifiers

• The accession number:
  • A letter for Histology, Cytology or Autopsy
  • The year
  • LIS accession number
  • Example: 16H-9999-1-A

• Second identifier:
  • Barcode
  • Patient name or initials
  • Patient’s birthday

• If possible, the anatomical site can also be added

2- conditions of storage and retention period

Parmesan (parmigiano reggiano) cellar in Italy (35000 m²), owned by the Milanese bank: Credem,
This cheese ensures the repayment of the loans of the producers
• Neither consent nor a license is required for the storage of material for diagnostic purposes for the benefit of the person from whom the tissue was removed during life.

• Pathology departments are responsible for the oversight and protection of this material.
The facilities

• Legal dispositions of conservation of medical records:
  • stored specimens should remain intact and accessible for the full term of their retention
  • The facilities must be locked to ensure confidentiality of records
  • No alteration of temperature, humidity, no direct sun light
  • About 18°C (66°F) with humidity of about 50%

• Regarding paraffin blocks there are very few recommendations:
  • Temperature <26° (78°F) and > 30% and <70% humidity

• Proteins and DNA are quite stable over time but not RNA

Retention periods: 3 levels

• **Law:** Very few specific legal requirements in this field: usually between 2 to 10 years according to countries

• **National college of pathologists:** established some recommendations superior to legacy duration

• **State or institution policies:** at least equal to college recommendations
## Paraffin block retention periods around the World

<table>
<thead>
<tr>
<th>country</th>
<th>references</th>
<th>periods</th>
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<tbody>
<tr>
<td>USA</td>
<td>CLIA 88 Record Retention Requirements (42 CFR 493,1105)</td>
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<td>CAP guidelines (2016)</td>
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<td>New York State</td>
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<td>20</td>
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<td>Duke University Health System laboratories (2016)</td>
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<td>indefinite</td>
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<tr>
<td>Canada</td>
<td>Canadian Association of Pathologists</td>
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<tr>
<td></td>
<td>Ontario laboratory guidelines</td>
<td>20</td>
</tr>
<tr>
<td>Alberta Health service (2016)</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Australia</td>
<td>Australian government Department of Health (2013)</td>
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<td>France</td>
<td>Private laboratories: Decree 88-280 du 24 mars 1988</td>
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<td>Public laboratories: Considered as part of medical records</td>
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<tr>
<td>Belgium</td>
<td>Code déontologie belge</td>
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<tr>
<td>Netherland</td>
<td>Dutch pathologist society</td>
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<tr>
<td>Italy</td>
<td>Ministry of health (2016)</td>
<td>10</td>
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<tr>
<td>Germany</td>
<td>Musterberufsordnung, MOB §10 (1998)</td>
<td>12</td>
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<tr>
<td>United Kingdom</td>
<td>Royal College of Pathologists (2015)</td>
<td>30</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Cantonal laws</td>
<td>indefinitely</td>
</tr>
</tbody>
</table>
Retention periods: remarks

• Retention time for children is usually longer (until the child reached the age of 25). In most cases, to comply to these standards all paraffin blocks have to be retained for the extended period.

• In case the initial diagnostic materials were discarded, patients are not eligible for enrollment in clinical trials.
How long do you keep paraffin blocks? 128 French labs

- **PUBLIC 2005**
  - 10 years: 5%
  - 20 years: 11%
  - 30 years: 84%
  - >30 years: 0%

- **PUBLIC 2015**
  - 10 years: 10%
  - 20 years: 11%
  - 30 years: 79%
  - >30 years: 0%

- **PRIVATE 2005**
  - 10 years: 53%
  - 20 years: 18%
  - 30 years: 8%
  - >30 years: 0%

- **PRIVATE 2015**
  - 10 years: 47%
  - 20 years: 21%
  - 30 years: 20%
  - >30 years: 12%

Retention period
3 – Retrieval management

Saran: 100 000 m² of storage for 8 million products: Only Amazon distribution center in France
Why and when do we need to retrieve blocks?

• For diagnosis/Prognosis/therapeutic purposes:

  Diagnostic: first month

  complementary techniques | expert advices | molecular pathology | clinical trials

  .....1 to x years....

  Patient relapse

  molecular pathology
  clinical trials
Why and when do we need blocks?

• For diagnostic/Prognosis/therapeutic purposes:

  - Diagnostic: first month
  - Patient relapse

• At any time: research, pedagogy... TRACEABILITY
Mayo clinic paper 2011 – Retrieval experience

- Mayo clinic: Tissue Registry Archives Warehouse
  - Since 1907
  - 15 Million slides, 6 Million paraffin blocks

- In 2005 they realized the following:
  - 300 000 blocks, 1 million slides were generated
  - 155,000 slides / 57,701 blocks were loaned out
  - 40% of slides and 54% of blocks not returned by the due date (2 mths)

• Issues identified:
  • large numbers of slides and blocks in separate tissue collections (5 investigators maintained 56% of the total number of blocks in their own lab)
  • inconsistent identification of the requesting physician/scientist
  • Transfer between investigators without sharing information back to Mayo
  • Investigators leave the institution with no follow-up back to Mayo...

Mayo clinic paper 2011 – Retrieval experience

• Implementation of a new tracking system with new policies:
  • who can borrow,
  • purpose of borrowed material (research, clinical, education, quality)
  • Time frames for return of material
  • Notification of overdue material
  • Penalties

• New procedures:
  • Mayo now makes investigators sign a verification form online;
  • the investigator must be authorized to request materials
  • have no overdue material outstanding

Mayo clinic paper 2011 – Retrieval experience

• 2008: 206 330 slides and 51 416 blocks borrowed
  • 94% of blocks and 93% of slides were returned
  • lost: 44 slides and 25 blocks (< 0.05%)

• Staff members workload increased by 58% for slides
  and by 17% for blocks

Conclusion: improvement of traceability but with a large
increase of resources

Release and return of archived diagnostic samples for clinical trials purposes

• Wherever possible, derived materials from a stored tissue block (e.g. tissue sections, extracted nucleic acids) should be provided, rather than the block itself.

• At least one block of diagnostic tissue should be preserved for the minimal retention time of paraffin blocks and should not be used for research, education, quality control, or any other non-diagnostic activities.
4 – long-term archiving: what cost?

Cellar of the “banque de France”, property of the French republic: About 2500 tons of gold, 82 billion euros are kept less than 25 meters beneath the ground in the middle of a groundwater in Paris
Search results
Items: 0

No documents match your search terms
Do you know the cost of long term archiving in your lab?

- 81% said No
- 52% said Yes partly
- 26% said Yes totally
- 17% of Public 2015 said Yes partly
- 22% of Private 2015 said Yes partly
- 2% of Public 2015 said Yes totally
Our long term storage experience!
About 2 Million blocks in a 60m² (645sq feet) room: 20 years of archiving
# LONG TERM ARCHIVING

Cost of gathering 2M blocks (est 20 years)

<table>
<thead>
<tr>
<th>Items</th>
<th>Core Archiving</th>
<th>TOTAL Cost (EURO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage room 130 euros/m2/year</td>
<td>390 per year x20 years</td>
<td>81,510</td>
</tr>
<tr>
<td>2 millions blocks in 60 m2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shelves, drawers and cardboards</td>
<td>13,000 x 20</td>
<td>260,000</td>
</tr>
<tr>
<td>Headcount 10 hrs/months</td>
<td>2,040 x20</td>
<td>40,800</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL - EURO</td>
<td></td>
<td>382,310</td>
</tr>
<tr>
<td>TOTAL - USD</td>
<td></td>
<td>~ 400,000</td>
</tr>
</tbody>
</table>

*DOES NOT INCLUDE ROUTINE MANAGEMENT – JUST LONG TERM ARCHIVING*
## LONG TERM ARCHIVING

**Ongoing costs**

**2M blocks – 100K per year**

<table>
<thead>
<tr>
<th>Items</th>
<th>Core Archiving</th>
<th>Extra cost per year for new blocks</th>
<th>TOTAL per Year (EURO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage room 130 euros/m2/year</td>
<td>7,800 (*increases every year)</td>
<td>390</td>
<td>8,190</td>
</tr>
<tr>
<td>2 millions blocks in 60 m2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>0</td>
<td>13,000</td>
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<td>0</td>
<td>2,040</td>
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</tr>
<tr>
<td>TOTAL - EURO</td>
<td>7,800</td>
<td>15,430</td>
<td>23,230</td>
</tr>
<tr>
<td>TOTAL - USD</td>
<td>8,345</td>
<td>16,509</td>
<td>~ 25,000</td>
</tr>
</tbody>
</table>

Every 5 years about 125,000 USD of cost

*DOES NOT INCLUDE ROUTINE MANAGEMENT – JUST LONG TERM ARCHIVING*
Block archiving reimbursement?

• The AMA CPT system has a block retrieval code: 88363
  • “Molecular assays are now being used as a part of selecting specific antineoplastic treatment regimens, which require pathologists to retrieve previously diagnosed surgical pathology cases and determine appropriate material(s) for these assays.”
  • Medicare Reimbursement for CPT 88363 includes a Medicare Non-Facility Payment of $22.88 and a Facility Payment of $19.67

• Long term archiving is an unfunded mandate for pathological labs
Tissue archiving: take home messages

- **Identification:**
  - Use automatic labelers connected with LIS
  - Avoid batch work
  - Use two identifiers (accessioning number/bare code)
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**Retrieval tracking:**
- Increase need to de-archive blocks
- Difficult to improve without additional resources
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• **Economical issue:**
  • Very few data but more expensive than we think
Part 2: Evaluation of a new block management system
Our department of Biopathology

- 30,000 biopsies and surgical samples
- 10,000 cytological samples/year
- 110,000 paraffin blocks/year
- IHC, FISH, HRM, NGS..

- 10 pathologists, 3 molecular biologists, 8 residents
- 17 + 4 technicians, 3 lab aids, 4 secretaries
- Biobanking: 4 people
Pilot site for testing automation of paraffin block management

- Medical Device Rating department
- Cooperation in the development (contract 8605 – 4/12)
- Testing of prototypes
- Installed in July 2014
1 - Block management in our lab before automation
First step: block sorting

- blocks were sorted by numerical order in metallic drawers
- Drawers took up a lot of space
- Need to move a lot of blocks when large cases came in late (autopsies, fetal pathology, bone specimens)
- Risks for misfiling of the blocks
Second step: block retrieval

- Manual removal of blocks without securing adequate space for returning
- Manual retrieval and re-archiving
- Inconsistent use of block registry (only used for long term removal of blocks)
Third step: final archiving

• Once a week, blocks were transferred from metal drawers into cardboard drawers for long term storage
<table>
<thead>
<tr>
<th>Function</th>
<th>Tasks</th>
<th>FTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Aids</td>
<td>• Block sorting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Long term transfer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Long term retrieval</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Manual register</td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Lab Technician</td>
<td>• Block research for complementary techniques</td>
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<tr>
<td></td>
<td>• Manual register</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secretaries</td>
<td>• Block research for external requests</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Database management</td>
<td></td>
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<td></td>
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<tr>
<td>Pathologists</td>
<td>• Block research for educational and scientific works</td>
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</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>1.4</strong></td>
</tr>
</tbody>
</table>
2 - Paraffin block automation
First step:

- The blocks are stored in a tray at the cutting station (240 blocks/tray).
- They are placed in the tray in any order (time-saving).
- Once the technicians have finished cutting they scan the tray in FINA.
When we insert a new tray, the scanner will detect it and ask us to print a new label to stick on the tray.

Scanning time varies from 2 to 6 minutes due to number of blocks, quality of printing and cleanliness of the paraffin block.
If the barcode is damaged, a picture of the block is taken and it can be entered manually in the software.

Percentage of unread blocks: 242/26400 (< 1%)
Primary reason: paraffin covering the barcode
2nd step: searching for blocks
Selected blocks are added to the picking list (1)

Once the list is completed it’s exported to the PDA (2)
For each block, we can log into the system the reason for removing it and the expected duration of time it will be out. Next, we can have alerts requesting any delays in re-archiving it.
Blocks removed are scanned with the PDA ensuring all needed information is captured in the database.

When ready to be returned, the pulled blocks are replaced in the current tray and re-scanned.
3\textsuperscript{rd} step: long term storage

- We’ve created 2 storage zones
- Trays are stored in cabinets in the lab zone for 2 years
- Afterwards, we transfer the trays to cupboard sleeves in our long storage zone
<table>
<thead>
<tr>
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<th>FTE</th>
<th>Impact Automation</th>
<th>New FTE</th>
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<td>Lab Aids</td>
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<td></td>
<td>1.4</td>
<td></td>
<td>0.4</td>
</tr>
</tbody>
</table>
3 - Traceability
Block history

Identification
16.15213

Résultat
16.15213-01A
16.15213-01B
16.15213-01TU

Identification
Zone labo

Numéro du plateau
Position

Plus d'informations

Photo

Ajouter au panier
Historique du bloc
Block history
# Block history

## Historique du bloc: 16.15213-01B

<table>
<thead>
<tr>
<th>Date</th>
<th>Opérateur</th>
<th>Événement</th>
<th>Détails</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/06/2016</td>
<td>14:21:35</td>
<td>Déplacement de plateau</td>
<td>Plateau: 2016-00237, Nouvelle zone: Temporaire Laboratoire</td>
</tr>
<tr>
<td>16/06/2016</td>
<td>14:32:44</td>
<td>Scan de bloc</td>
<td>Plateau: 2016-00237, Position: C27</td>
</tr>
<tr>
<td>17/06/2016</td>
<td>11:13:55</td>
<td>Changement des informations</td>
<td>Nouvelle information : decaussin</td>
</tr>
<tr>
<td>17/06/2016</td>
<td>11:13:55</td>
<td>Scan de bloc</td>
<td>Plateau: 2016-00237, Position: C27</td>
</tr>
<tr>
<td>20/06/2016</td>
<td>09:48:07</td>
<td>Sortie manuelle</td>
<td>Demandeur: Dr Rousset, Raison : Avis</td>
</tr>
<tr>
<td>10/08/2016</td>
<td>13:09:38</td>
<td>Déplacement de plateau</td>
<td>Plateau: 2016-00237, Nouvelle zone: Coulair Laboratoire</td>
</tr>
</tbody>
</table>
How many blocks did we retrieve in 2016? And why?

About 20% (19412) of blocks were retrieved in 2016 so a tight management is needed.
Due blocks out of the system at the end of 2016

- Second Opinion, expert consultation: 138
- Clinical trials: 45
- External research (biobank): 29 ( + 360 definitive exits)
- Internal research: 75
- Externalized techniques: 16
- Blocks used for positive controls: 4

With information about the recipient, the protocol number etc....
• **Gain of resources**
  - we are saving 1 FTE in time savings
  - we are working on the connection of FINA to our LIS

• **Block traceability**
  - Know where blocks are at all times
  - Who, when and why
  - Reduces errors

• **Frees up space in the lab**
  - 4 linear meters

• **Implements safety and regulatory**
  - Minimizes risk of loss
  - Allows for block QC
  - Unique tray for long-term storage

**In conclusion**