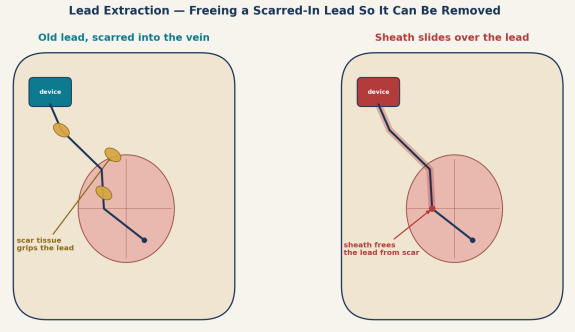
Understanding Lead Extraction

Removing pacemaker or ICD wires (leads) from the heart and veins — when, why, and how

A lead is the wire connecting your device to your heart. Sometimes a lead must come out. This guide explains when, why, and how it is done safely.



Online: https://go.riasalimd.com/lead-extraction-guide

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Names & Terms You Will Hear

Term	Meaning
Lead	The thin insulated wire that runs from your pacemaker or ICD (the battery box under the skin) through a vein and into the heart. It carries the signals. This guide is about removing one or more leads.
Lead extraction	Removing a lead that has been in place long enough to scar into the vein and heart. It needs special tools and an experienced team. This is different from a simple lead removal.
Lead removal (simple)	Pulling out a newer lead — usually one in place less than about a year. There is little scar tissue yet, so gentle traction is often enough.
Sheath	A long narrow tube that slides over the lead to free it from scar tissue. Types include laser sheaths (light energy) and mechanical sheaths (a cutting or rotating tip).
Laser sheath	A sheath that uses pulses of light at its tip to gently vaporize the scar holding the lead. A common brand name is the GlideLight excimer laser sheath.
Mechanical / rotational sheath	A sheath with a powered cutting or threaded tip that bores through scar tissue. Brand names include Evolution and TightRail.
Pocket	The small space under the skin, usually below the collarbone, where the device sits. In infection cases the pocket is cleaned out as part of removing the whole system.
CIED	Cardiovascular Implantable Electronic Device — the umbrella term for pacemakers, ICDs, and CRT devices. A CIED infection is the top reason a system is removed.
Complete system removal	Taking out the whole device and ALL of its leads. This is required when the system is infected — leaving any part behind lets the infection come back.

Term	Meaning
Vegetation	A clump of infected material that can form on a lead inside the heart. Large vegetations change how the lead is removed and may need a surgical approach.
Reimplantation	Placing a new device or leads after the old ones are out. It may be on the other side, delayed until an infection clears, or replaced by a leadless pacemaker or subcutaneous ICD.

The single most important point.
The biggest reason a lead must be removed is **infection of the device or leads**. An infected pacemaker or ICD system **cannot be cured by antibiotics alone** — the bacteria live on the hardware. The whole system (device and every lead) must come out. Watch for **fever, chills, or redness/drainage at the device site** and call us right away.

What Is Lead Extraction?

- Lead extraction means removing one or more of the wires (leads) that connect a pacemaker or ICD to your heart. The wires run through a vein near the collarbone down into the heart.
- Soon after a lead is placed, scar tissue starts to grow around it. Over months and years the scar grips the lead to the vein wall and the heart. This is normal. But it is why an older lead cannot just be pulled out.
- A NEWER lead (in place under about a year) usually has little scar. It often comes out with gentle pulling. This is called traction, or simple removal.
- An OLDER lead is stuck in scar. To free it, the doctor slides a thin tube over the lead. This tube is called a SHEATH. Laser sheaths use light energy. Mechanical sheaths use a cutting or spinning tip. The sheath frees the scar so the lead can come out.
- The biggest reason to remove a lead is INFECTION of the device or leads. An infected system must come out fully — the device and all leads. Antibiotics alone cannot cure it.
- Other reasons include a broken or worn-out lead, a recalled lead, or a blocked vein. A lead may also be in the way of a needed upgrade, such as adding a lead for CRT.
- This is a harder procedure than placing a device. It is done by an expert team in a hybrid OR or EP lab. A heart-surgery team is ready as backup.

Reason for Removal -> How Urgent -> What Usually Follows

Reason a lead is removed	How urgent	What usually follows
Device or lead INFECTION	Urgent — remove the whole system now	All hardware out + antibiotics; new device delayed until infection clears (often leadless or other-side)
Broken or worn-out lead	Soon — schedule once confirmed	Remove or replace the lead; a new lead is often placed at the same visit
Recalled lead (safety advisory)	Soon — case-by-case decision	Shared decision to remove vs. monitor; replace if removed
Lead blocking a needed upgrade	Planned / elective	Remove the lead to clear the vein, then place the new (e.g., CRT) lead
Too many old leads / blocked vein	Planned / elective	Remove some old leads to free the vein; sometimes switch sides or go leadless

At-a-Glance — The Three Big Questions

WHY it comes out

- Infection (biggest reason)
- Broken or recalled lead
- Too many / blocking leads
- In the way of an upgrade

HOW it comes out

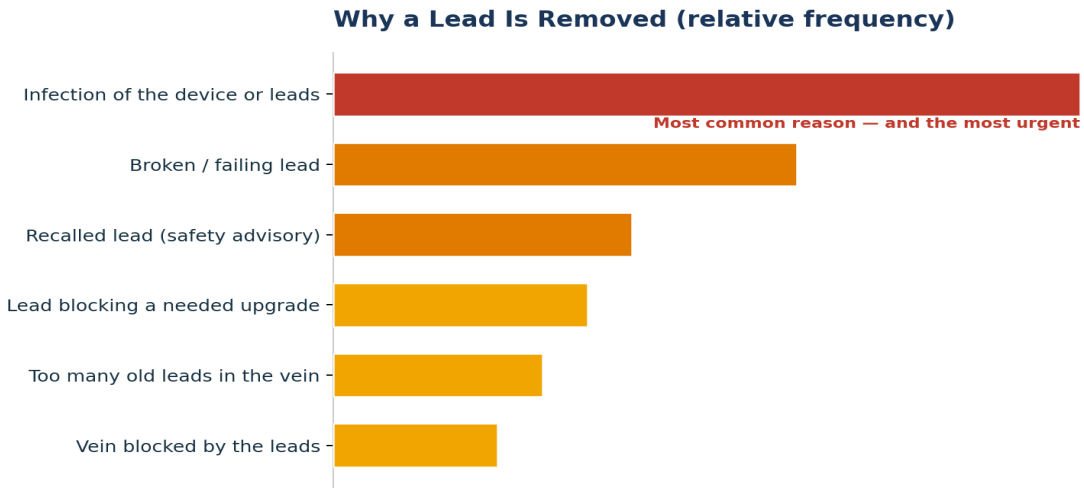
- Newer lead: gentle traction
- Older lead: a sheath
- Laser or mechanical sheath
- Experienced center + backup

AFTER it comes out

- New device — same day or later
- Maybe the other side
- Leadless pacemaker option
- Subcutaneous ICD option

Why It Matters

- An infected device or lead will not heal on antibiotics alone. The germs hide on the metal parts. The ONLY sure cure is removing the whole system. Leaving leads in lets the infection come back. It can become life-threatening.
- A broken or failing lead can cause missed beats or false readings. In an ICD it can cause painful, unneeded shocks. Removing or replacing it brings back steady therapy.
- Leaving many old, unused leads in the vein can crowd or block it. That makes future care harder and can cause arm swelling. Sometimes removing old leads is what makes an upgrade possible.
- Where you have this done matters. Expert, high-volume centers have higher success and fewer serious problems. The 2017 HRS guide says extraction should be done by trained doctors with surgical backup.
- Removing a lead is more risky than putting one in. But at expert centers it works very well. Large studies (ELECTRa, LExICon) show the lead is fully or nearly fully removed in well over 95% of cases. Serious problems happen in only about 1-2%.



Bars are relative, not exact percentages. Color shows urgency: red = urgent (infection), orange = removed soon, amber = planned/elective.

Why leads are removed. Infection of the device or leads is both the most common reason and the most urgent — an infected system must come out completely. Other reasons (a broken or recalled lead, a blocked vein, too many leads, or clearing the way for an upgrade) are usually less urgent and can be planned.

Why a Lead Comes Out — Infection vs. Malfunction

- INFECTION is the top reason and the most urgent. It cannot be cured with antibiotics alone. The whole system must come out and the pocket must be cleaned. Watch for fever, chills, and redness, drainage, or thin skin over the device.
- If a device infection is not fully cleared, it can spread to a heart valve. This is called endocarditis. It is serious and can be life-threatening. See our endocarditis guide: https://go.riasalimd.com/endocarditis-guide.
- MALFUNCTION means a broken, worn-out, or damaged lead. This can cause missed beats, false readings, or — with an ICD — painful, unneeded shocks. The lead is removed or replaced to bring back steady therapy.
- RECALL means the maker put out a safety advisory about a lead model. Whether to remove it is a shared choice. You and your doctor weigh your own risk against the risk of removal.
- CROWDING means too many old leads fill or block the vein. This can cause arm swelling or get in the way of a new lead, such as one for CRT. Removing old leads can make an upgrade possible.

Where you have this done matters.
Lead extraction is safest at an **experienced, high-volume center** with a **heart-surgery team on standby** — a standard set by the 2017 HRS consensus and supported by large registries (ELECTRa, LExICon). Having a surgical team ready is a **safety feature**, not a sign that something is expected to go wrong.

Risk Factors

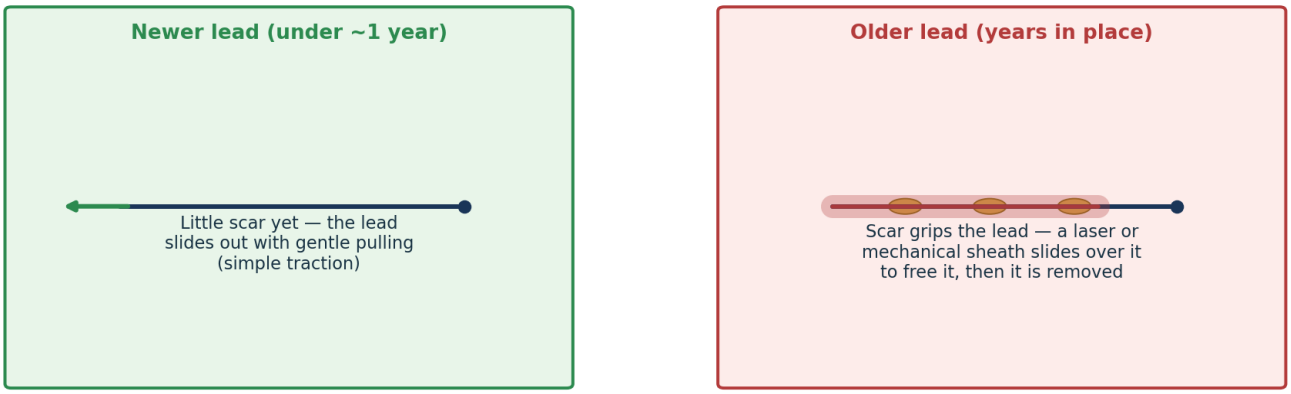
Some patients are more likely to develop this condition. Knowing your risk helps your care team take extra precautions.

Risk Factor	Why It Increases Risk
Older leads (many years in place)	The longer a lead has been in, the more scar tissue grips it. Older leads are harder to free and more likely to need a sheath.
ICD (defibrillator) leads	ICD leads are thicker and have shock coils that scar in heavily. They are generally harder to remove than thin pacing leads.
Several leads in the same vein	More leads mean more scar and more crowding. Removing one without disturbing the others takes more skill.
Female sex and smaller body size	Smaller veins and a thinner heart wall give slightly less margin, which can raise the chance of a tear during extraction.
Active infection or large vegetations	Infection makes complete removal essential and can change the approach. Large clumps of infected material may call for a surgical route.
Lower-volume operator or center	Outcomes are best at experienced, high-volume centers. This is why referral to such a center is often recommended.

Treatment Options

- Before the procedure, scans map your leads and check for infection or clots. These may include an echo and sometimes a CT scan. Blood tests are drawn if infection is a concern. Your team plans the safest path.
- You are in a hybrid OR or EP lab. This is a room set up so heart surgery can start at once if it is ever needed. A heart-surgery team is on standby. This backup is a safety feature, not a sign of trouble.
- Most extractions are done while you are fully asleep. A temporary pacing wire may be placed if your own heart rate is slow and leans on the device.
- The doctor first frees the lead at the pocket. For a newer lead, gentle pulling may be enough. For an older, scarred lead, a laser or mechanical sheath is slid over the lead. This frees it from the scar. Then the lead is pulled out.
- If the system is infected, the WHOLE system is removed — the device and every lead. The pocket is cleaned out. You then get antibiotics, often for several weeks, before any new device.
- Recovery for a planned case is usually 1-2 days in the hospital. It is longer if infection needs IV antibiotics. You will have arm limits for a few weeks, much like after a device implant.
- A new device or leads may go in at the same visit, for a simple swap. Or they may go in later, after an infection clears. The new system may go on the other side. It may also be a leadless pacemaker or a subcutaneous ICD.

How a Lead Comes Out — Traction for New Leads, Sheaths for Old Ones



How a lead comes out depends mostly on its age. A newer lead has little scar and often slides out with gentle traction. An older lead is gripped by scar, so a laser or mechanical sheath is slid over the lead to free it before it is withdrawn.

Extraction Approach by Lead Age

Lead age	Scar tissue	Usual approach	Difficulty
Under ~1 year	Very little	Gentle traction (simple removal)	Lowest
~1-5 years	Moderate	Traction, sometimes a sheath	Moderate
Over ~5 years (and most ICD leads)	Dense scar	Laser or mechanical sheath over the lead	Highest

How It Is Removed — Gentle Traction vs. Sheaths

- TRACTION (simple removal): a newer lead, under about a year old, has little scar. The doctor frees it at the pocket and gently pulls it out. This is the easiest case.
- SHEATHS: an older lead is gripped by dense scar along the vein and in the heart. A thin tube — a sheath — is slid OVER the lead to free it. Then the lead is pulled out.
- LASER SHEATH (for example, the GlideLight laser): uses brief pulses of light at the tip. It melts the scar a tiny bit at a time.
- MECHANICAL SHEATH (for example, Evolution or TightRail): uses a powered cutting or spinning tip to bore through scar. The doctor picks the tool to fit the lead and the scar.
- The whole procedure is done in a hybrid OR or EP lab. A heart-surgery team is on standby, and you are usually fully asleep. Expert, high-volume doctors have the best results. See our pacemaker and ICD guide: https://go.riasalimd.com/pacer-icd-guide.

After Removal — Reimplant Options and Newer Alternatives

- If the reason was a simple lead swap, not infection, a new lead often goes in at the same visit. It may go on the other side if the vein is blocked.
- If the reason was INFECTION, a new device is usually held off until the infection clears. A temporary pacemaker may be used in between if your heart needs it.
- A LEADLESS PACEMAKER may be an option if you need only one chamber paced. It sits inside the heart with no chest leads and no pocket. See our leadless pacemaker guide: https://go.riasalimd.com/leadless-pacer-guide.
- A SUBCUTANEOUS ICD (S-ICD) places its lead under the skin, never inside the heart or veins. It is a strong choice after a lead infection or when veins are hard to use. See our S-ICD guide: https://go.riasalimd.com/s-icd-guide.
- If you still need ICD shocks or resync therapy, your team will talk through a standard ICD or CRT too. See our ICD and CRT guide: https://go.riasalimd.com/icd-crt-guide.
- Some patients no longer need the old therapy and may not need a new device at all. You and your cardiologist decide this together.

Comfort Measures at Home (No Medication Needed)

These simple steps support healing and ease symptoms. Use them alongside any medication your doctor prescribes.

- Keep the incision clean and dry as instructed, and watch for redness, swelling, drainage, or fever — report these right away.
- Follow the arm-activity limits your team gives you (usually no lifting over about 10 pounds and keeping the arm below shoulder height for a few weeks).
- Rest as needed for the first few days; short, gentle walks help recovery and lower clot risk.
- Set up your remote home monitor for any new device so your clinic can check it without an extra trip.
- Carry your device ID card and keep a simple written list of which leads were removed and what (if anything) was put back.

Risks, Benefits, and Alternatives

Every choice has trade-offs. Use this table to start the shared decision conversation.

Option	Risks	Benefits	Alternatives
Transvenous lead extraction (through the vein)	Serious complications occur in about 1-2% at experienced centers. The most feared is a tear of a vein or the heart, which is rare but can be life-threatening (this is why a surgery team stands by). Other risks: bleeding, a temporary need for a pacing wire, or a piece of lead left behind.	Removes infected or broken hardware completely. Cures device infection that antibiotics alone cannot. Clears the vein for future leads. The lead is fully or nearly fully removed in well over 95% of cases.	Surgical removal (open or hybrid) for very large vegetations. Leaving (capping) the lead in selected non-infected cases. Doing nothing — acceptable only when the lead is not causing harm and is not infected.
Capping / abandoning a non-infected lead	The old lead stays in the body. It can still scar further, take up vein space, and rarely cause problems later. It cannot be left if the system is infected.	Avoids the risks of extraction. Reasonable for a single, older, non-infected lead in a patient where the vein is not crowded and no upgrade is planned.	Full extraction — preferred when infection is present, the vein is blocked, or many leads have built up. Shared decision with your cardiologist weighs your age, vein status, and future needs.
Complete system removal for infection	Requires removing the whole device and all leads, then a course of antibiotics and a waiting period before any new device. Temporary pacing may be needed in between.	The only reliable cure for a device or lead infection. Prevents the infection from returning and from spreading to heart valves (endocarditis).	Antibiotics alone — NOT reliable for hardware infection and not recommended as a cure. Partial removal — not acceptable; the whole system must come out.

Option	Risks	Benefits	Alternatives
Reimplant choice after extraction	If infection was the reason, a new device is usually delayed until cultures clear. Timing and side are individualized.	Lets you keep needed pacing or defibrillator protection with a fresh, clean system — sometimes a simpler or leadless option.	Leadless pacemaker (no chest leads), subcutaneous ICD (no leads in the heart), the opposite-side chest, or — if you no longer need the therapy — no new device at all.

Common Misconceptions

Myth	Reality
If my device is infected, antibiotics will clear it without surgery.	Not reliably. Bacteria cling to the device and leads where antibiotics struggle to reach. The standard of care is to remove the ENTIRE system, then give antibiotics. Leaving hardware in lets the infection come back.
Removing a lead is just pulling it out, the same as putting it in.	No. After months to years, scar tissue grips the lead to the vein and heart. Freeing it safely often needs a special sheath and is more demanding than the original implant — which is why it is done by an experienced team with surgical backup.
Any cardiologist or hospital can remove my lead.	Lead extraction is a specialized procedure. Guidelines recommend it be done by trained, high-volume operators in centers with a heart-surgery team on standby. Outcomes are clearly better at experienced centers.
Old, unused leads are harmless, so they should always just be left alone.	Often they can be left, but not always. Many old leads can crowd or block the vein, get in the way of an upgrade, and cannot stay if the system is infected. Whether to remove or cap a lead is a shared decision.
The surgery team on standby means something is likely to go wrong.	It is the opposite. The standby team is a safety net required by guidelines. Serious tears are rare (about 1-2%), but because they are dangerous, the team is ready so help is instant if it is ever needed.
Once my leads are out, I will definitely get a new device right away.	Not always. For a simple swap, a new lead may go in the same day. After an infection, the new device is usually delayed until the infection fully clears — and it may be a leadless or subcutaneous option, or placed on the other side.

Myth	Reality
Lead extraction means open-heart surgery.	Usually not. Most extractions are done through the vein (transvenous) using sheaths, with no chest opening. Open or hybrid surgery is reserved for special situations, such as a very large infected vegetation.

Possible Complications

Knowing what can go wrong helps you spot problems early. Most complications are uncommon, especially with treatment.

Where / What	What Can Happen
Tear of a vein or the heart wall	The most serious risk. Freeing a scarred lead can rarely tear the vein (superior vena cava) or the heart wall, causing sudden bleeding around the heart. This is why a heart-surgery team stands by. It happens in well under 1-2% of cases but must be treated immediately.
Bleeding or fluid around the heart (tamponade)	Blood collecting in the sac around the heart can press on it and lower blood pressure. It may need urgent drainage or, rarely, surgery. The standby team allows fast treatment.
Need for a temporary pacemaker	If your heart depends on the device for a normal rate, a temporary pacing wire is used during and sometimes briefly after the procedure until a new device is placed.
Damage to the tricuspid valve	The lead crosses the tricuspid valve. Removing a scarred lead can occasionally injure the valve and cause it to leak. This is uncommon and is weighed against the reason for removal.
Incomplete removal (a fragment left behind)	Rarely, a small piece of lead cannot be removed safely and is left in place. Your team decides whether this is acceptable based on infection status and risk.
Bleeding or clot in the pocket	Blood can pool at the device site, more so in patients on blood thinners. Most clear with time and pressure; large ones may need draining and can raise infection risk.
Blood clot or vein narrowing	A clot or scar can narrow the vein after a lead is removed. This is often silent but can cause arm swelling or make a future lead harder to place.
Infection spreading to a heart valve (endocarditis)	If a device infection is not fully treated by complete removal plus antibiotics, it can seed a heart valve. This is serious and is exactly why the whole system must come out.

Points to Know

If you remember nothing else, remember these key points.

- A lead is the wire from your device to your heart. Over time it scars into the vein, which is why an older lead needs special tools to remove.
- Infection of the device or leads is the biggest reason for removal — and it is urgent. An infected system must come out completely; antibiotics alone will not cure it.
- Other reasons include a broken or recalled lead, a blocked vein, too many old leads, or a lead in the way of a needed upgrade.
- Newer leads often come out with gentle traction. Older leads need a laser or mechanical sheath slid over the lead to free it from scar.
- Have this done at an experienced, high-volume center with a heart-surgery team on standby. This is a safety standard, not a warning sign.
- Serious complications are uncommon (about 1-2%) and the lead is removed successfully in well over 95% of cases at expert centers — but the risk is higher than a routine implant.
- After removal, your team will discuss whether you need a new device and what kind — including a leadless pacemaker or a subcutaneous ICD.
- Call us right away for fever, chills, or redness/drainage at the device site — these can signal the infection that makes extraction necessary.

When to Call Us - and When to Call 911

If you are not sure, call. We would rather hear from you twice than miss a real problem.

- Fever, chills, or shaking that you cannot explain — especially with a pacemaker or ICD in place. This can mean a device infection. Call us today.
- Redness, swelling, warmth, drainage, or skin breakdown over your device or its scar — call us today. The skin thinning over the device is a warning sign.
- A device site that looks like it is eroding through the skin — call us right away, even without fever.
- New or worsening arm swelling on the device side — call us this week. A vein may be narrowing or blocked around the leads.
- Repeated ICD shocks, or your device alerting that a lead is not working — call us promptly so we can check the lead.
- After an extraction: chest pain, shortness of breath, fast heartbeat, lightheadedness, or fainting — call 911. These can signal a rare but serious problem.
- After an extraction: fever, spreading redness, or drainage at the incision — call us today.
- Any time you are told a lead may need to come out and you want to understand your options — call us. We will walk you through it.

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Trusted Resources

The links below are the trusted resources Dr. Ali used to write this guide and that he recommends you visit for more information. Each is a clickable link in the digital version and a Short.io tracked URL on the printed version.

- Cleveland Clinic — Lead Extraction - Patient-friendly overview of why leads are removed (infection, malfunction, recall), the sheath tools used, and what recovery looks like.
- Mayo Clinic — Pacemakers and device care - Plain-language background on devices and leads, including why leads scar in over time and why removal needs an experienced team.
- Heart Rhythm Society — Patient Resources - Patient education from the society that writes the lead-management and extraction guidelines — when leads should come out and the centers that do it.
- American Heart Association — Devices for Arrhythmia - AHA overview of pacemakers, ICDs, and CRT in plain language — useful background before learning about lead removal.
- MedlinePlus — Pacemakers and Implantable Defibrillators - Government health resource summarizing device and lead basics, risks, and follow-up.

Sources Used to Build This Guide

Every recommendation in this guide is grounded in one or more of the studies, guidelines, or trusted resources below. Short links are tracked so Dr. Ali can see which references patients are reading; nothing personally identifying is captured.

- 2017 HRS Expert Consensus Statement on Cardiovascular Implantable Electronic Device Lead Management and Extraction *[Guideline]*
  Authoritative basis for extraction indications (infection, lead failure), the named laser/mechanical tools, operator and high-volume-center requirements, complication rates, and the rule that an infected system must be removed completely.
- 2019 ESC / EHRA Consensus on Lead Extraction *[Guideline]*
  European consensus aligning on indications, transvenous extraction techniques, and the surgical-backup / experienced-center safety standard.
- Cleveland Clinic — Lead Extraction *[Patient Education]*
  Patient-facing overview of removing pacemaker/ICD leads for infection, malfunction, or recall; laser/mechanical sheaths; recovery expectations.
- Mayo Clinic — Pacemaker / ICD lead management and removal *[Patient Education]*
  Plain-language framing of why leads scar into veins over time and why specialized removal tools and an experienced team are needed.
- Heart Rhythm Society — Patient resources: Devices and Lead Management *[Patient Education]*
  Society patient material framing when leads need to come out and the specialized centers and teams that perform extraction safely.
- American Heart Association — Devices for Arrhythmia *[Patient Education]*
  AHA plain-language overview of pacemakers, ICDs, and CRT that anchors what the leads do before explaining why one might be removed.
- MedlinePlus — Pacemakers and Implantable Defibrillators *[Patient Education]*
  NIH/NLM background on devices and leads to anchor why and when a lead may later need extraction.
- ELECTRa Registry — European Lead Extraction ConTRolled (Europace) *[Registry]*
  Largest prospective registry of transvenous lead extraction — source for real-world clinical-success and major-complication rates and the volume-outcome relationship cited in the guide.
- LExICon Study — Lead Extraction in the Contemporary Setting (JACC) *[Registry]*
  Multicenter U.S. laser-extraction outcomes study supporting the >95% success and low procedural-mortality figures used in the complication framing.

About This Guide

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Reviewer note: Reviewed against Cleveland Clinic, Mayo Clinic, AHA/HRS, and Heart Rhythm Society patient pages. Ours adds: a cover diagram showing how an old lead scars into the vein and how a sheath slides over it to free it; a reasons-for-extraction breakdown with urgency color-coding (infection first); a traction-vs-sheath figure keyed to lead age; a reason -> urgency -> what-follows table and an approach-by-lead-age table; honest, registry-anchored complication and experienced-center framing (2017 HRS consensus, ELECTRa, LExICon); and explicit reimplant options including leadless pacemakers and the subcutaneous ICD.

Disclaimer

This guide is for educational purposes only and does not replace medical advice from your physician. Recommendations may not apply to every patient. Always follow the specific instructions of Dr. Ali and your care team. In an emergency call 911 or go to the nearest emergency department.

Take This Guide With You

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