

**RESTITUCIÓ FUNCIONAL I
ESPECIFICITAT DE LA REINNERVACIÓ
DESPRÉS DE LESIONS I REPARACIONS
DEL NERVI PERIFÈRIC**

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VI. Conclusions

1. Després de lesions de compressió, secció o resecció del nervi ciàtic de la rata, els axons tenen capacitat per regenerar i reinnervar dianes musculars, sensorials i sudomotores i permetre el restabliment de respostes funcionals.

A excepció de les lesions de compressió (grau II de Sunderland), la regeneració axonal en lesions de grau V de Sunderland assoleix nivells de restitució funcional inferior a la dels valors preoperatoris o d'un grup control no lesionat. Els mètodes electrofisiològics i funcionals utilitzats permeten mesurar la progressió de la reinnervació i la recuperació funcionals per part de diferents tipus de fibres nervioses ($A\alpha$, $A\beta$, $A\delta$ i C) simultàniament.

2. L'inici i el nivell final de la regeneració de diferents tipus de fibres nervioses després de lesions depèn de la gravetat de la lesió i de l'eficàcia del mètode reparatiu aplicat.

La compressió nerviosa mostra una bona recuperació fins a valors semblants als preoperatoris. Els gups de resecció mostren nivells de reinnervació distals inferiors als dels grups de secció. La reparació per sutura directa és la millor tècnica reparativa de troncs nerviosos plurifasciculars i mixtes, sempre i quan es pugui garantir un correcte alineament. La tubulització en distàncies interneurals curtes és una bona alternativa quan hi hagi risc de realitzar sutures a tensió o alterar l'orientació fascicular. En lesions de resecció i distàncies interneurals mitges/llargues la tubulització única o fascicular amb guies de silicona obté pitjors resultats que la reparació per un autoinjert ideal. La tubulització amb guies semipermeable de PLC és una bona alternativa a l'empelt.

3. Les fibres nervioses mielíniques i amielíniques manifesten diferent capacitat de regeneració i reinnervació distals.

Les funcions mediades per fibres primes amielíniques nociceptives o sudomotores (C) mostren en tots els grups una reinnervació més ràpida i assoleixen nivells finals de recuperació superiors a les mediades per fibres mielíniques gruixudes motores ($A\alpha$) i sensorials ($A\beta$). La recuperació de funcions mediades per fibres primes no permet discriminar entre els efectes de procediments reparatius diversos, que sí presenten valors diferents de reinnervació muscular i sensorial per fibres gruixudes.

4. No totes les dianes musculars i sensorials perifèriques tenen la mateixa capacitat de ser reinnervades després de lesions.

La reinnervació de dianes distals té lloc de manera més tardana i en menor grau que la dels òrgans diana proximals. El múscul plantar i els nervis digitals mostren dies d'inici més tardans i valors finals inferiors de recuperació que la dels músculs gastrocnemi i tibial anterior i la del nervi tibial a nivell del taló. La recuperació de la funció motora i sensorial a nivells proximals no discrimina entre grups sotmesos a diferents tipus de reparacions que mostren per contra, nivells significativament diferents de reinnervació distal.

5. L'assoliment d'uns bons nivells de reinnervació motora i sensorial a l'extremitat posterior no garanteix la recuperació de la funció global de locomoció.

Només després de lesions compresions s'observa una recuperació significativa del patró de locomoció. Les lesions de secció o resecció alteren de manera no reversible la activitat locomotora, independentment de l'èxit d'alguns procediments reparatius com a promotors de la reinnervació muscular i sensorial.

6. Després de lesions de nervis plurifasciculars, el patró de reinnervació no reproduïx el mapa original de projeccions d'axons motors, sensorials i sudomoters.

Tots els grups experimentals mostren, en diferents graus, reinnervació aberrant de dianes per axons de fascicles no corresponents, neurones motores amb dobles o triples projeccions axonals en diversos músculs i poliinnervació de fibres musculars. Noranta dies després de la lesió, els nivells de reinnervació fascicular aberrant no superen, però, en cap grup els nivells de reinnervació funcional correcta. Els mètodes electrofisiològics i histològics utilitzats permeten quantificar les alteracions que la lesió produeix sobre l'especificitat de la reinnervació, el grau d'hiperinnervació de dianes i el nombre de motoneurons amb projeccions múltiples funcionals.

7. El grau de reinnervació funcional aberrant, innervació múltiple i poliinnervació de dianes depèn del tipus de lesió i del mètode reparatiu utilitzat

Les lesions de compressió presenten la reinnervació més específica de tots els grups estudiats, encara que no lliure d'alguns errors de la reinnervació. Les lesions de secció mostren percentatges de reinnervació funcional aberrant, dobles projeccions musculars i poliinnervació inferiors als dels grups de resecció. En lesions de secció, la sutura directa ben alinada és la reparació de referència, encara que la tubulització origina menys errors de reinnervació que la sutura equivocada amb desalineament fascicular. En distàncies interneurals mitges/llargues, la tubulització fascicular redueix de manera significativa el grau de reinnervació aberrant i de múltiples projeccions. La tubulització amb guies de PLC redueix significativament els nivells de reinnervació muscular aberrant i el nombre de motoneurons amb múltiples projeccions respecte a la reparació per empelt o la tubulització amb guies de silicona.

8. Els diferents tipus de fibres nervioses no mostren diferències en la seva capacitat per reinnervar específicament dianes perifèriques.

La major capacitat de regeneració i reinnervació de les fibres nervioses amielíniques no comporta un increment del percentatge de reinnervació funcional aberrant, hiperinnervació o poliinnervació respecte a les mielíniques. No hi ha diferències entre els nivells de reinnervació funcional aberrant de dianes proximals o distals, però les primeres mostren nivells de poliinnervació muscular superiors i les segones d'hiperinnervació polineuronal.

9. La regeneració i la reinnervació comporten una ràpida restitució de les respostes reflexes monosinàptiques i polisinàptiques després de lesions perifèriques.

Les lesions del nervi perifèric comporten l'abolició de les respostes reflexes espinals. La reinnervació sensorio-motora restitueix en tots els grups experimentals els circuits del reflex monosinàptic ($A\alpha$) i dels components inicials del reflex polisinàptic (C1 i C2, mediat per fibres sensorials $A\beta$ i $A\delta$). El component C3, mediat per fibres C, es recupera de manera més lenta en un proporció inferior d'animals.

10. El temps de conducció dels reflexos monosinàptics i polisinàptics s'incrementa amb la lesió i es recupera amb la reinnervació fins a valors finals propers als originals.

En el reflex monosinàptic, els grups de secció i els músculs proximals mostren una recuperació del temps de conducció més enlentida que la dels grups de resecció i els músculs distals, però sense diferències significatives al final del seguiment. En els reflexos polisinàptics, no hi ha diferències entre els nivells finals de recuperació del temps de conducció dels diferents components (C1, C2, C3) ni entre diferents tipus de lesió i reparacions.

11. Les lesions perifèriques indueixen una facilitació de respostes reflexes monosinàptiques i polisinàptiques que disminueix a mesura que té lloc la reinnervació distal

La relació d'amplituds entre l'ona M i l'ona H i l'amplitud màxima dels components C1, C2 i C3 dels reflex polisinàptic s'incrementen respecte dels valors controls en les primeres fases posteriors a la lesió i tenen tendència a normalitzar-se a mesura que progressa la reinnervació. Els components reflexos mediat per fibres gruixudes mielíniques i els circuits reflexos amb dianes musculars distals mostren nivells de facilitació superiors als mediat per fibres amielíniques o als de grups musculars proximals.

12. El tipus de lesió i de reparació condicionen la involució de la facilitació de reflexes monosinàptics i polisinàptics induïda per la lesió perifèrica

La facilitació de l'activitat reflexa i l'increment de la resposta és dependent del grau i la qualitat de la innervació muscular i sensorial en cada moment del seguiment. Al final, el grup de compressió mostra valors d'amplitud més propers als preoperatoris. Els grups de secció i de resecció no mostren diferències significatives en el grau de màxima facilitació de respostes reflexes en les primeres fases de la reinnervació. La reparació per sutura en distàncies interneurals curtes i l'empelt i el tub de PLC en lesions de resecció mostren al final del seguiment valors de resposta reflexa més ajustats als preoperatoris que la resta de grups homòlegs. La recuperació de la facilitació dels reflexos polisinàptics és inferior a la dels monosinàptics.

VII. Bibliografia

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