Phlébologie 2013, 66, 2, p. 15-27

Article original

Histoire des techniques endoveineuses dans le traitement des varices.

The history of endovenous techniques for treating varices.

ZSC pGNNNlMn

Résumé

f2KBFFN @>™KJ<:B>JS8NPON<B< ON8BGSJGPGNFFN SJL9JGGN,P<SQB9PKN9ON<8N<<JN<SCJFSGN8SJ:GS PS@SPJ™@S:J?9N>ON<JCINP:JBCN<8S>JPN<BC: PBCC9N9FBJC<ON@9jJ@@BP:N.{#AAS8hp3l

oN<<N>JCL9N<™:SGGJ?9N@<:BC<BC>N>B98™N<SC< GN<9JCN<NaBF@™Jl

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Mots-clés : *histoire de la médecine, traitement endoveineux, grande veine saphène, petite veine saphène, varices.*

Summary

Prehistoric man was able to perform injections using poultry bones as a needle and his mouth or an animal bladder as the reservoir for fluids. Varicose veins have been known at least since the days of Hippocrates (-400 b.c.e.).

Piston-action metal syringes have been found in the ruins of Pompei.

Transparent syringes and metal needles date from the nineteenth century.

In the twentieth century, foam and echographic monitoring revolutionized the treatment of varicose saphenous veins.

In the early 21st century, surgeons abandoned the "dogma of crossectomy" and attempted to replace stripping with thermal endovenous treatments (laser, radiofrequencies, steam ablation).

New pharmaco-mechanical techniques are currently being assessed for the treatment of large-diameter varicose saphenous veins.

Keywords: KJ<:B>BMFNOJPJCN,CO8NCB9<:>NS:FNC:, GSL>N<S@KNCB9NJC,<FSG<S@KNCB9NJC,8S>JPN<l

De l'aiguille à la mousse sclérosante : l'endoveineux chimique

Aiguille, seringue et ligature

fS :K>BFQB<N@S>PS9:™>J<S:JB9CNON<@N>FJ'>N< :NPKCJ?9N<NPKJ>9JN8NJCN9<1N(,;$l pN::N:NPKCJ?9N@S>MBJ<<BPJ™9CNGJLS:N>B9 9CN N6:J>@S:JB9P>BPKN:O9>S ON 2SC:J?9JS9XiX<J'PGN .***A.C. Celsus***, ¤(AA0***C. Galien***, (!A 0***Oribasius***, *!A 0***G. de Chauliac***, (*%* 0***A. Paré***, (!!A3l

f2SJL9JGGN9<NMSJ:N@S>J>O2B<ON8BGSJGN<NPBCC9N ON@9JGS@>™KJ<NBeJ<N® S QB9PKN,GNK™S@N9:N @N9S<@N>B9 <B9MMGN<SJ?9JON,J™N9C >™<N8BJ> PBFFN9CN8N<<JNSCJFSG9N,NJCINP:JBC:@B<<JQGNl

jJ@@BP:N>S@@BS>9CN:K>BFQB<N8NJCN9<<NPBCONJ> ® 9CN@J?Â>¤#AAS8hp3l

oN<<N>JCL9N<@<:BCBC:™:™N>B98™N<SC<GN<9JCN< ONaBF@™:SBÂ:")3l

ZN><G2S9C!A,9CN@N:J:<N>JCL9N<:PJ:™@SCN™ONPJC L>NP***P. Égine***l

J.F. Van Cleef, 43, rue de la Chaussée d'Antin, 75009 Paris, France.
E-mail : IM8SCPGNNMSUL>NIM>
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Accepté le 28 mars 2013

FIGURE 3 : Estampe vers 1737.

Lorsque l'injection est faite, le trocart enlevé, on place sur la piqûre un petit bourdonnet de charpie maintenu au moyen d'une bandelette de diachylon. On met ainsi obstacle à la sortie du sang.

La bande, roulée autour de la cuisse pour faire gonfler la veine, est enlevée; mais elle est remplacée par deux bandelettes de diachylon placées à 5 centimètres environ, au-dessus et au-dessous de la petite plaie; cette double compression circulaire autour du membre a pour effet d'emprisonner le coagulum dans un espace restreint et de ne pas permettre son déplacement. Quelques chirurgiens ont craint de voir le caillot emporté au loin dans les gros vaisseaux produire une embolie. Pour l'éviter, M. Desgranges (1) laisse la bande circulaire de la cuisse dix ou quinze minutes après l'injection; M. Gosselin, cinq minutes (2). Au contraire, MM. Pétrequin (3), Chassaignac (4), Maisonneuve (5), l'enlèvent immédiatement après l'injection.

(1) Mémoires de la Société de chirurgie, tome IV, page 373, et Bulletin de thérapeutique, tome XLIX, page 341.
(2) Cité par M. Caron ; Thèses de Paris, 1856.
(3) Gazette médicale de Paris, 1853.
(4) Gazette hebdomadaire, tome I, page 401.
(5) Cité par M. Caron.

FIGURE 4 : Page 66 de la thèse de P. Rouby sous la direction de X. Delore. Avis divergeant sur la compressothérapie pendant l'injection sclérosante. Publié en 1867.

ZN><()!A, GS<BPJ™ ***Sédat Pérouse médical*** ® i>JLC5 MSQ>J?9DN<<N>JCL9N<C @GS<:J?9N™>JGJ<SQGN< >™9:JGJ<SQGN< GS<N>JCL9N:SQGNN96B9 :>BJ< @J'PN<8NFIBJCON<JGJPB<2NF@B<Nl

Les produits thrombosants et sclérosants

nC8BJP9CNGJ<:S8NFGN@>JCPJ@@BO9J:<_

- (y!* _ G @NPKGB>N9N M>:nl pS>BC,:K'<N NC(y!%3l
- (y!# _ G G?9N9>JBOBSCCJ?9N(A$ZSGN::N,N>N?9JC,]B?9N:¦3l aB9> F™FBJN, G2JBON<: 9:JGJ<™NC @KS>FSPJN<(y((, @9JCNPKGB>fl aB>S3l
- **1864** _ X o NGB>FBC:S ?92JGPBCNCSJO2JCINP9NC @BO9J:CBC:K>BFQBL'CN?9J SG:™J: GS@B>J @B9> <PGB<N>GN8S>JPNf2JBON@B:S<<J?9N9N96@NCO> SGB>:B9:N <S 8SGN91(A$f2JO™DN<PG™>9N><9< :K>BFQ9<3<NS O™NGB@@(™AN SC<@G9:S>O @> mSCPlpKGNJ()!3 1(#$l
- ()A# _ <BG9:JB@K™CJ?9™N. \S8NG3l
- **1908** _ G Ù8BJNJCINP:SQGN<: JC<P>JS9 pBON6ON< @KS>FSPJNC@N9OBCP>N 9JGJ<™N9SOFJCJ<N> ON<F™OJPSFNC:<l
- ()(A _ G <9QGJFB9FN>P9>N PB>B<JN]PKS>3l
- **1916** _ a f J<:N>NFS>?9N?9NGN<9Q<:SCPN<>J:SC:N< PBFFN GN]SG8>SC9:JGJ™OS<GN>SJNFNCON G<5@KJG @B8B?9NC:ON<:K>BFQB<N<ON<8NJCN<O9 QS<l iG @B@B<N 29JGJ>N<@BO9J:<J>JSC<@B9 G<P™B<Nl
- ()(" _ G LG9PB<K5@N>BCJ?9NgS9<PK3l
- ();A _ G P>QBCSON<B9ONnl]JPS>3l
- **1922** _ fN <SGJP5GSN<B9ONnl]JPS>3l fS ?9JCJC9N>™:KSCNNC™8>JN>3l fN QJJBON>N FN>P9>N fSP>BJ63l
- ();! _ G PKGB>N>N <BOJ9FK5@N>BCJ?9Ngl fJ<:N>3l fS LGB™>JCNl
- ()*A _ G FB>>K9S:ON<B9ONJLLJCLgJ::NG3l
- **1932** _ G LGB™>JCNBF™Nl
- **1933** _ G BOBJBO9>™BOJ?9NkN><BCN: NC()!) GN< @BG5JBO™SQJGJ<iF<BMJ]JLL3l
- **1946** _ G :™:SO™P5G<9GNSBNON^NJCN>3l
- **1966** _ 2B5@BG5™5KBO™PSNC<PKNGJPKNCQN>3 @BO9J:O™l@B@B<™BFFN SCN<:K™<JSGBPSNC ()*%l pN@BO9JN<:S9<<JGN@G9<JGJ<™P:9NGGNFNC: NOmSCPNl

pN<@BO9J:<<BC9:JG<™<N9<B9 @S>BJ<PBFQJ™NC:>N N96B9® ON<SCN<:K™<JSNC:<B9ON<8S<BPBC<:>JP:N9><1((,(;, (*, (!$l

De la fabrication de la mousse

`9S:>N @JCPJ@ON<MSQ>JPS:JBC:9:JGJ<™2SLJ:S:JBC O9 QBPSGG2™PB9GNFN9<Q9GNCGS QS<<NB9 GS <9>@N<<JBC:GNFJ6N{QS::N9> fN 8>SJ @BQG'FNN<: GSMSQ>JPS:JB29CNFB9<<N <:SCOSJ<™N>S@@B>S4UGJ?9JON<PB<J:™S,JGGN< Q9GGN<¦3l

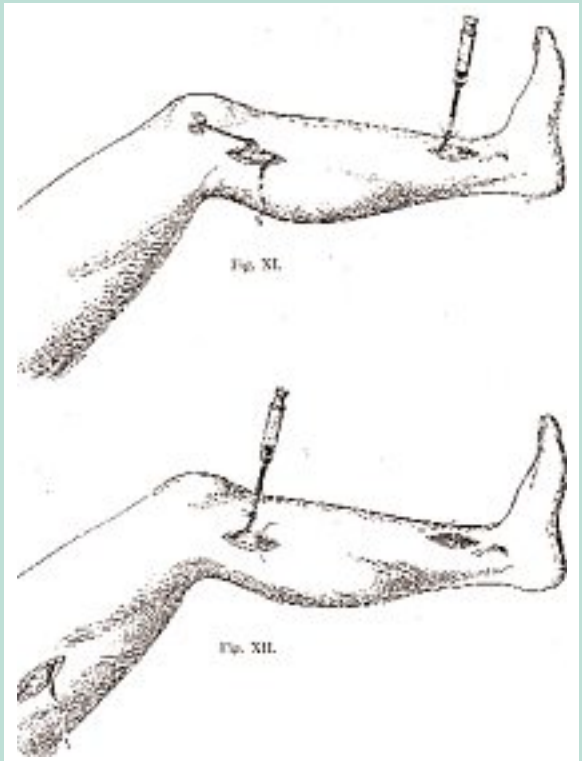

FIGURE 5 : Injection d'iode aqueux.
B. Schiassi, Bologne, 1913.

FIGURE 6 : Machine standardisant le va-et-vient pour la fabrication de la mousse, 2004

eSJ<>N8NCBC<® 2KJ<:BJ1%,(", (y$l

- nC **1939**, ***S. Mc Ausland*** @>™N'8™P9FN029CMGSPBC <NB9™ N FB>K9:N N:2CINP:N_ GFB9<<N<PG™B>SCN N<:C™1N()$l
- f2SJ>QGBPNPKCJ?9N ***E.J. Orbach*** 0 ***R.R. Foote***, ()##3 @9J<SJ BSFJCLQGBPNPKCJ?9N N ***K.Sigg*** NC()#) <N<9PP'ONC1;A,;(, ;;, ;*$l
- nC **1953**, N <9™OBJ ***A. Ree*** JCINP:N6PG9<N8FNC:ONGS FB9<<N,CJ>CJ?9JC1,#$l
- nC **1957**, ***H. Mayer*** N: ***H. Brücker*** >™SGJ<NN@>FJN> OJ<@B<J@B9>MSQ>J?9N>GSFB9<<N_ 9CN <N9GN <N>JCL9NB9QGNJ<:B1C!, ;%$l
- nC **1962**, ***P. Lukenheimer*** @B>@B<N9C CB98NS9 OJ<@B<J:JNCN MJBGN F™OJPSFNC>NGJ™N 9CN <N>JCL9NN OJ<@B<J@N>FNGSMSQ>JPS:JBNGS FB9<<N@S>9>Q9GNCPNOJ<@B<J<NN FBON>CJ<™ NC())) @S ***A. Frullini*** ?9JSIB9:N9C SOS@:S:NN9C:N GNMGSPBCGS<N>JCL9N($l
- nC **1969**, ***W. Gillesberger*** @B>@B<9CN:NPKCJ?9QS<<N @N<<JBC® 2SJON029CN<N>JCL9NC 8N>N pN::N :NPKCJ?9NS >N@>J<N:SF™GJB>@S ***A. Monfreux*** NC ())" <B9<GNCBF ONF™:KBONÙ e[] Þl ***S. Sadoun*** >NF@GSPGS<N>JCL9NC8N>N @>9CNNC@GS<:J?9N ***M.S. Gaston*** O™P>9CN :NPKCJ?9QS<<N@N<<JBC 9:JGJ<S®: CB98NS99C MGSPNC8N>N C:N>F™OJNSJ> 1;), *A$l

- ***G. Hauser*** O™@B<NQ>N8N: NC()y# O29CNDB9QGN <N>JCL9NNP9CNPKSFQN B <N F™GSCLNC2SN>GN GJ?9JCNPGB<SC:OSC<9C >SJB({(S8NP9C Q9: ON <:SCOSJ<S:JBC'$l
- nC **1986**, ***M. Grigg*** PBCMNP:JBCCNGSFB9<<N NC PBCCNP:SC<N>JCL9NS8NP9CN:9Q9G9N>:NPKCJ?9N >N@>J<NC,AAA@S ***L. Tessari*** S8NP9C>BQJCN® * 8BJN<l rP:9NGGNFNCGS>'< L>SCONFSIB>J:™ON<@S:JPJNC< 9:JGJ<NCN<8S>JSC:N<ON PN::NF™:KBONS8NP 9C PBCCNP:N9MNFNGGN{MNFNGGN96 <N>JCL9N ***L. Moraglia*** 3 1;, **$l

  [CN @BF@N™GP>?9N \9 >QBMBS E3 N<: PBFFN>FJSGJ™N NC;AA! @B9><:SCOSJ<N>SN8S[N:{8JNCON<ON96 <N>JCL9NSJ<GSFSIB>J:™ON<F™ONPJCNBCP:N8S[N:{ 8JNCFSC9NGGNFNC:l
- nC **1995**, ***J. Cabrera Garrido*** 9:JGJ<9CNQ>B<<N>BS:J8N ® G FSCJ'N 29CFJ6N>SGJFNC:NJ@B9>MSQ>J?9NCN FJP>BFB9<<N>'< PBF@SP:N' G2SN<:>NF@GSP@S> O9pb;l

  pN::N FB9<<N N<: 9:JGJ<™CBC<N9GNFNC@B9>GN< 8NJCN<<S@K'CNFSJ<S9<<J@B9>GN<FSGMB>FS:JBC< 8NJCN9<N<,NL>SCON?9SC:J:™<BC:9:JGJ<™NC9CN <™SCP1N$l

Une injection sous contrôle

'8J:N>G2NGS8S<S:JBO9@B>O9J<PGB<SCB9, @JN,<BC JCINP:JBC:S{S>™>JNGNGS@>™BPP9@SNBC9<GN< F™ONPJCS<P9GSN<l

r9 O™Q9:GN<SJL9JGGBNC: 9CN F™OJBP>?9SGJ:™N @™CS:JBCNCNCO8NJCN96bN PNMSJ:GN<@S:JPJNC< @>™NC>O™C9ONPS:K™:™>JGSNJCNfN QNN6NF@GN ONPN::NF™:KBONN<: PNGGN™P>J@NS ***A. Schiarri*** l iG BQ<N8NF,FN GS<B>JNO9GJ?9JONO™@SS>O™C9OS:JBC <B9<{ISPNC:Nl

fS ?9SGJ:™N<QJ<NS96ON<SJL9JGGN2<SF™GSB>GS @BCP:JB>SC<P9:SC™2NF@B<Nl

oBJL:™N:PBC:>ÉGN>NMG96N8JNCCNC<NC:JNG<l

fN< <N>JCL9NK8N>>N C9F™B:™N<BCF™:JP9GN9<NFNC:
NC:N:NC9N@SCNSCPJNC<l
]NGBCGSDJMMJP99LN<:NJGNCPKBJ<J<<NCC9F™B,
S8NPGN@<BC<JCN>PKSCNSQGNJGN<NC:@>SCQGNFNC:
S9LN<:NGNPB9GJ<<NFNCBONlll
pN<@>™PS9:JBCHLSSC:J<<NC@S<PBF@G':NFNCCN
G2JCINP:JBCS{S>™>JNSBPNJONC:NGGNl

q9::N>MCN5PS:K™:NPB9><BC:9:JGJ<™@SPN:SJC<@B9>
GN3JCINP:JBC<S@K™CJNCC2NBONl

fN< S<@NP:™PKBSL@KJ?9NS8SC: N: S@>'<JCINP:JBC<
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R. Knight @>™<NCON< <PGB™<N< ™PKBL9JO™®N<
]: >S<QB9L>1'), #A$lr9 PB9><ONPNF,FN PBCL>'<***J.F. Van Cleef*** @>™<NCONMJG<9>G2NCOB<PBCONBG9FJCSGN
ON<<S@K'CNO,N<8SG89GN:9CN<PGB™<N<B9<PBC:>ÉGN
NCOB<PB@J'19#($N:, 9C SC @G9<S>O, ***P. Raymond-Martimbeau*** @B@B<N O29:JGJ<N>G2™PKSB@KJN
NCOBS<P9GSNJ8SSC:N:S@>'<PGB™<N1#;$l

f2S8NCJN<:® S :K™S>@JNCOBS<P9GSNJ>B9< NC<BC:
@N><9SO™<l

ZJNC:SGB><SSDJMM9<@BGSC™NSDN>G™PKB<PBCN@B9>
GN<4BCN<<S@K™CJNCCN<?9N<@B9>GSaZ] N: <N<
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S8NP<BCQ>9JONÙ PKS<<NO2NSN SF9<N G2S9OJNB***J.A. Cornu Thénard***3 #)$l

Position, stratégie, manœuvre, compression, cathéter

h9<?2®GSMJCON<SCC™N)yA, OS:NO2S@@S>JCJBC
G2™PKB<PBGN;C2B@S™N9>JCINP:NBC@BO9J:OSC<GN
:>BCP<S@K'CN<BJ:OSC<9CN8NJCNO™C9O™NB,J:NC
:>SC<P9:SCSNP9C>N@™SLN® S @SG@S:JBCFJN96,®
GS@SG@S:@BP9<<JBCl
fS @B<J:JBC9 @S:JNCOBJ:,:>N PBCMBSQGN@B9>G9J{
F,FN N:@N>FNN>9C >N@™SLNMSPJGNl

nC**1930**, ***A. Warter*** >™SG9<NGJMSPJGJSZCJCINP:PBCN4
9C@S:JNCCNQB9P,S>® PN::N™@B?9N2JCINP:OBCQB9:
N<:@>™PBCJ<™Nl

ZN><()!A, BCO™8GB@@BS9<SaZ] GS@B<J:JBCNCB9
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OJBN>NC:_

- ***Tournay***, ***Wallois et l'école française*** @>™PBCJ<ONC:
:>SJ:N<SN@BJCG3NM9J:NBCP:JBC@N>NBB>N<3@9J<
GN>™<NSBS>J?9N96G9J{F,FN0
- ***Sigg et l'école suisse*** @>™PBCJ<9NC:>SJ:NFNCCON
QS<NCKS9:NC?9NG?9NB9><8BJ>N C 9CNMBJ3<
- ***Fegan et l'école irlandaise*** CN @>™PBCJ<NCC GS
<PGB™<NON<@N>NBB>N<,® 2™:SLNSFQJN<SN>BCP
<S@K'CN® S P9J<<NONSJ:,:>N @™<8™@B9>GN<
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pN::N ON>CJN >K™B>JN2JF@B<NSC<GNFBCON
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>NPBFFSCO™ONFSCJ'>N<OJBN>NC:N<l
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SPP™G™@B@NB<NCB9<<NONGS:NQS<C5GBNCQSCON
PBGGSC@B9@G9<JN9NFSJCN1<A,!(, !:, !*, !#, !!, !%$l

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ONFNFQ>N, JCINP:JBNC8NJCN8JONS8NP9CN@B<NON
QSCONBF@N<<JB SNP B9 <SC<QB9GONFB9<<NB9 ON
PB:BC@B99CNPBF@N<<JBC@G9™GNPNJ8C FS<<SLN
B9 9CN PBF@N<<JBC>5:KF™N® 2SJONON GS<BCON
O2™PKBC@KJNB9NSB>J<N9C<@S<FN¦

H. Leonhardt, NC **1952**, S<<BPJ9CNGJLS:N>ON GS]m N:
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1!)$l

nC**1957**, ***P. Fluckiger*** @B@B<9CNJCINP:JBC™BL>SONON
FB9<<NS<<BPJ™N9CN™GS:JBCONGSISFQNl pN::N
F™:KBONNS SP:9SGJ<@N***G. Gachet*** NC**2001** 1*#,!A$l

G. Cloutier .**1980**3 S @B@B<9CNPBF@N<<JBC@NCOSC:
G2JCINP:OBCGS]m B9>S9LFNC:NSNF@<ONPBC:SP:
NC:N N @B09J:<PGB™<SCN:GS@SB>8NJCN9<Nl

C. et J.L. Robert FJ>NC:S9@BJC9CPS:K™:NGBCL™PKB{
B@S?9N <BCN6:>™FJ:@B9PN::NF,FN SP:JBC**1995**3
B9@B9S2JCINP:OBCB9<<NNC8NJCN8JON***R. Milleret***,
20013 1%A;%($l

nC**2005**, ***J. Brodersen*** >™SG9<NJCINP:JBCNFB9<<N®
G2SJCON29CPS:K™:NGBCL® QSGGBCC@N>FN::SC9CN
BPPG9<JBCF@BSJNFNC: ON GSh]m B9> GN<>BCP<
<S@K'CNGNOJSF':N<JF@BSC:<1%;$l

L'endoveineux mécanique : de la réduction à l'obstruction

Les dispositifs largables

Les dispositifs filiformes

o'< GSMJO9XiXN<J'PGN9PS:L9:@>™SGSQGNNFNC@™
OSC<9CN<BG9:JBC2JBONN:GSJ<?9NG?9NB9><OSC<
GSG9FJ'N SJ?9N9<NG<2SLJOBCPO29COJ<@B<J:JM
:NF@BSJNl
fN< PBÓGN<8NJCN<<S@K'CN@>™<NC:NCN<>J<?9N<
FJL>S:BJN<l

FIGURE 7 : Canules de phlébo-aspiration, 1986.

FIGURE 8 : V Clip endosaphène, obstruction par aplatissement, 1992.

Les dispositifs circulaires d'obstruction

oN :B9< :5@N≤ QSGGBCQPÉ,CN<;N<B>< PJP9GSN>®
<@N>™L9GN>B9 CBC,JG<@>™<NC:N2JCPBC8™CJNQ;
O2,:N @SG@SQ<BB<GS@NSN: ONP>™N<B98NC:9CN
JCMGSFFS:JBBCP9C8BG9FNON:K>BFQ9<<9<{N:<B9<{
ISPNCS9OJ<@B<J:JM
rP:9NGGNFNGN:Z{qGBPHNMB>FNPBCJ?9NCCJ:JCBG
a\m N<: NCPB9><O2™S8G9S:JB1C%*$l

Les dispositifs plans

o™MJCJ<<SN96MSPN<:ON96QB<@B99CN8NJCN*J.F.*
Van Cleef O™@B<NC ())(GNQ>N8N: O29C>N<<B>
NCO8NJCN96@GS@B9B<Q<:>9NGSG9FJ'N 8NJCN9<ON<
h]m N h]a N: SJC<J@B:NC:JSGJ<2N>MKON<@BO9J:<
<PGB*<SC:<@B9<N>BCP<S@K'CNl

pN PGJ@™:SGGJ?9NSNSLC™:J?9NC MB>FNON Z S
G2S8C:SLNO2,:N ™PKBL'CNlN PS:K™:N@BN9>ONPN
OJ<@B<@JN>FNS9<<ON>™@S<SFB9<<N<PGB*<SC:N
GNGBCO9:>BCP<S@K'CNl
fS @BP™CN9N:>S@JCN@N>MB>FSC:Nl
aG9<JN9F3GGJNONZ pGJ@C:™:™@B<™629CPBÂ:>'<
<9@™>JN9> 9CN <JF@GNCINP:JBCON FB9<<N, <S
PBFFNPJSGJ<S:NBCS>>,:™NC,AA! 1%#%!$l

Les valves artificielles

nGGN8BC:ISFSJ<O™@S<G™:SONONGS>NPKN>KN:CN
:>SJNC:?929CN @S>JNO9@BQG'FN _GSFSGSCJN8S>J9N9<N
C2N<: @S<9CN SMMNP:JBCFJ:™S96 <N9G<S@@NS>G<
8SG89GNSJ>

oN @G9<GS@B:K'<N OBJ:,:>N PBGGSQSQPBFN GS
G9FJ'N 8NJCN9<N:ON@9J***Aquapendante*** .(%A;3,CB9<
<S8BC<?9NPKS?9NQJ8G8S 9 F BJC<9CB>JMJCPN8NJCN
:>JQ9:SN>9<{ISPNC:l
oN FSCJ'N PBC<:SC:NJGN6J<:NS9 FBJC<9CB>JMJP9N<{
PBFFJ<<9SG***J.F. Van Cleef*** 3l f2™PB9GNFNQ2<SCL@S>
PN:B>JMJ@N>FN9C Ù S8SLNP SC:J{:KBFQB:J?9NON<
<JC98SG89GNSJ1%%$l

Les adhésifs

fN P5SCBSP>5G@SN9,:>N ™:SG™98NP9CPS:K™:NGBCLNC
8NJCN<S@K'CNl
fN PBGGSLN<N MSJ: OSC< G2SN6 @K5<JBGBLJ?9N
O2S@GS:J<<NCPNGSS@K'CN@SSGG'GNFNGS<9>MSPN
ONGS@NS9fS PBGGQNBPBF@S:JQCON9JCL>SC9GBFN
JCMGSFFSNB3>NGG9GN<SC:N@9J9CNMJQ<Nl
^N<:N® PBCCSBN>S :S96ON>™PJQNJ8>P>™S:JBC29C
MS9BKNCSG:N SPBGGNCOB:K™GJSNGGS™NOJ9%"$l

La phlébo-aspiration

oN FSCJ'N SCNPOB:J?9NM9O™FBC:N™()y% ?929CN
PSC9GN>™<NC:SC<B>JMJPBS:S96@N>FN*in vivo*,
ON @GS?9N<9> PN::NPSC9GN@S>S<@S>JBCGS@SBJ
<S@K™CJNCN)%$l
pN::N :NPKCJ?9NN >™8'GN@G9<BCL9N929CN<JF@GN
@KG™QNP:BFQ9GS:BJ>5@N9GGN>

Les dispositifs rotatifs

[C PS:K™:N>BS:JMMNCON9C?9S:N N<: 9:JGJ<N™()];
J.M. Lefevre 3 @B9>GSK>BFQBG5<N™FB{JGJS?9Nl
nC;A(A, 9CCB98NS9OJ<@B<@JN5>FSPB{F™PSCN8N
<BCS@@S>J:@BC9SN>SJ:NFNC:ON<8S>JPN<pGS>N8Cl
p2N<9C PS:K™:NGBCL29J @N>FNG2JCINP:@BCGJ?9JON
<PGB*<SC:N:GS>BS:JB@*!AA :B9><UFJC29CMJF™:SGGJ?9N
SG:S9C:G2NCOB:K™GGSFBQ:NC9GNFS>?9SLNpn N:
G2SPPBar 1%)$l

Les réducteurs de diamètre

iPJPN<BC:S8SC::B9: ON<SO98SC:< S96S9>N<:>S:NFNC:<
NCO8NJCN96_@S>FSPBGBLJ89N<N>FJ?9Nl
pGS<<J?9NFNGC<BC:S8SC::B9: N6:N>CNPBFFN GN<
QSCON9NPBF@N<<JBGCNQS<GNQB9GN9NGS:N6¦

FIGURE 9 : Cathéter Closure 8F de la société Vnus, 2000.

De la flamme à la vapeur : l'endoveineux thermique

La chaleur « électrique »

La cryochirurgie

FIGURE 10 : Mini treuil électrique pour le retrait continu et motorisé d'une fibre laser, 2004.

La lumière : source de chaleur

nC **1999**, ***C. Boné*** @9QGJBN<@NFJN><>™<9G:SC<N :>SJ:NFNC:NCOBG9FJCS9N<kZ] @S>GS<N>CJBONON y(A CF N: NC **2001** ***L. Navarro*** >S@@B< yA PS< @>™GJFJNCSJ>)%,)"$l

nC **2004**, ***M.P. Goldmann***, ***R. Weiss***, ***J.F. Van Cleef*** B9 ***C. Lebard*** 9:JGJ<NQC >N>SJ:FB:B>J<™N: PBC:JC9ONGS MJQN>B@:J?9N))$l

nC **2009**, m ***Pannier*** @B@B<GN(#"A CF N: ***M. Amgayyb*** PBF@S>G<NMMNO9GS<N(A,)#A N:O9(#"A CFl

mJQN>SJSGB9 MJQN>SOJSGN r9 QGBFB9 NCPSQJCN: F™OJP9GS ?9N<:JBON<:@B<™1(AA(A($l

La vapeur d'eau

nC **2007**, GS :NPKCJ?9NCOBNJCN9<@S@S@N9O2NSN<: C™Nl

bC 9:JGJ<@B9>PNGSCN@BF@N9J @N<<9>J<G2NS9 yA QS>9 PN::NNS9<B9<MBN @N<<JBN<:L9JO™NSC< 9CFJPB{:9QNON(AACSCBF':N<ONOJSF':NI[C @9G<N ON8S@N9O2NS99>PKS9MMN™NC85™ OC<GSBNJCN® JC:N8SGGN™L9GJSN<@BCP:JBONO™@S%SC:MSJ:S8NP 9CPS:K™:KN(%kl

nC **2011**, ***R.R. van den Bos*** @9QGGN<@NFJN>≈™<9G:S:< @B9;A kZ] B 9 aZ] S8NP9C>NP9GON% FBJ<1(A;$l

oN **2007 à 2009**, ***R. Milleret*** S >SJ:™(%#:>BCP<S@K'CN<l

De la polémique aux études comparatives

cB9< S8BC<PJ{ON<<B9B9<GN3CL>™OJNQB9OON:>'< QNGGNBG™FJ?9N<

f2JC<9MMJ<SBCPCN9<NPKBCJ?9N<9@N>MJPJNNGGN FSGSOJMSFJGJSONP;S9<NJCPBCC9N @B9>GS?9NGGN <:SCOSOJ<S:JBON<CB98NGGNNPKCJ?9N<l

fS FBO™GJ<S:JBNCG2™PB9GNFNCMG9JO8U<?9N96 OSC<ON<PBCO9J:NPBGGSQSNQGON<@G9PBF@GJ?9™Nl

fS FSGSOJ8S>J?9N9<N<:PKBCJ?9N:™BG9:J8PN?9J >NCO@G9OJMMJB2SNSGON<>SJ:NFNC:<JBC @BJO< ™PBCBFJ?9N<:GB9O>N@B9>SC:GN@B9BJ><@9QGJPS< O™CJNC:l

nGGJC:™N<<N@SJP9GJNFNC:GN@S:JNC:R9JO™<JC: S8BJ>ONQNGGNSFQN<N:PN<MNFFN<BC:<NC<JQGNS FBONON<CB98NS96>SJ:NFNC:<l

fN< Ù@KG™QBGB9LBC< ON<MB>FS:JBCCJN><N<JG< 8JNCCNCON SFKJ9>LJNL™C>SGN8S<P9GSN B9N<:K™:29N, ONGS>SOJBGBLJON,GSON>FS:BGBLJON,G2SCN<:K™<JN, >SNFNC:ONGS™ONPJCS<P9GSNJ>

\B9< PN<@S:JPJNC<BC:OBCP@G9® 2SJ<NOSC<9C OBFSJCNK™S@N9:J?9N: :>'< @N9ON@S:JPJNC<BC: PS@SQGON >™SGJ<N96{F,FN< :B9: G2N8:SJGON< :NPKCJ?9N<F™OJPB{PKLJPSGN<OJSLCB<:J?9N<N: :K™S@N9:J?9N<l

cB9< S8BC<@N9O2™:9ONJCOJ<P9:SQ9NJ<PBF@SNC: OJMNC:»>SJ:NFNC:F„FN <JBCCB:N?9NG?9N@BL>'< >™PNC:<l

pJ:BC?9NG?9N@BG™FJ?9N<

nC (y)#, GNPBCL>'<F™OJPSGN f5BC PBCOSFCSGS <PGB<NQJNC9NXl oNGBN>S O™MNCOJ(A$

oSC<GNaep ™OJ™C)((@S>S<<BC® aS>J<GNGJ8<ON >™MNCPNG2™@B2NSJ:NFNCON<8S>JPN<:@SGGJS:JM .PBF@N<<B:K™S@JS8NPON<QS<NC:J<<9<F™GSCLON MJGN<PB:BC;BJN:PSB9:PKB9NPNCPS<ONPBF@GJPS:JBC ¤ 9GPN, @KG™Q>JSJLCNFNC: P2N<:GS>™<NP:JBCN :B9:NGSNJCNS::NJC:N8P9CN<PGB<NC2N<:@B@B<™¦

¢ @S>J>ON()!A, GN™PBGMSCµSJ<N<B9>CS53,9J<<N .]JLL3, B9 SCLGSJ<MNLSC3S8NP GN9><OJ<PJ@GN< <2B@@B<NC> GS<:S:™LJB9 GN<JCOJPS:JBCON GS PBF@N<<JBC(A*$l

fS <PGB<NONPB<<NpGB9:JN()yA3 N<:OSCLN9<N: JCNMMJPSP2S@>'GN<PKJ>QJNC<lfN OBLFN ON GS PB<<NP:BFJN<:® <BCS@BL™Nl

]N>JCL9NC8N>N B9 <N>JCL9NC@GS<:J?9NC mSCPN® GSMJON<SCC™N(yA, GN@S:JPJNCNCSCO98N>N N O9 @GS<:J?9N2B@@B<NC(A#$l nC ())%, G2SPGN Ù pBFFNC: :NCJ:9CN<N>JCL9NC@GS<:J?9NS@@SB: @B9PN:SJC<PBFFN@B8BPS:N>F SJ<GN8J>9<O9<JOS N: GN@>JBCS9BC:>S<BCO9>™9:JGJ<SQGSPGB<N <B9< PBC:>ÉG™PKBS@KJ?9N™GBJLGNOSCLN>ON G2JCINP:JBCS{S>™>JNG<SC<8:SJFNC:NC ™GJFJCN> PBF@G':NFNGNJ<?9N NGBC{89N6J<:Nl

o2SJGGN9>GN<: SF9<SC: ON PBC<:S:N?9N PN:SJC< @S:JPJNC<N::NC: <B98NC: NC S8SC: GN<O™MS9GN <:SCOSOJ<S:JBON<CB98NGGNNPKCJ?9N<l

aS> NNF@GNJGMS9:,N: ® 9<:N >SJ<BC,9CN FB9<<N Q9GGN<¦3l

eSJ<<J8B9<BQ<N8N4 @G9<JN9@S:JPJNC<9PB9><O29CN
P>B<<NP:BFJ<N>J@@JCN<:™:BCCSCNPBC<:S:N>N
CBFQN9<N<OJMMCP>N_<@<J:JBO9@S:JNC>:S<SLNB9
CBC,SC:J<N@:J?9NPKN{@JNC>NISFQN<SLNCPNFNC:
ON<PKSF@<SCN<:K™<:JN@N O2JCPJ<JBCGBPSGJ<S:JBC
JF@B>SCPNONGSOJ<<NP:JBC5<@NONGJLS:N>ON<9:9>N,
ONPBF@N<<JBCNF@<ON>N@B<S8SC:GSFS>PKNO9>™N
ONG2S>>ON>S8SJGh: GSP>B<<NP:BFJN{N8SL<NSJ:9C
Ù LBG<:SCOS>hw B9:S9@G9<CNNPKCJ?9ON>™MCPNl

nCm>SCPNG2JCINP:JBNP:® 2SJL9JGGNSFB9<<NN<:GS
@G9<@S:J?9™N. ***C. Hamel Desnos***3 0OSC<GN<4BCN<®
>J<?9NPBFFN@B9>S aZ] ® S @BJC:N09FBGGN. ***J.F. Van
Cleef*** @>™PBCG2NF@G29CPS:K™:NPB9> pNPS:K™:N>
<NSJ:BQGJLS:NJ@B9>QBCCBFQN ON KJ>9LJNC<N: NC
:B9:N<GBPSGJ<S:JBC<l

bC O™FBCN>?9N GSFB9<<NN<: @G9<NMMJPS9N GN
GJ?9JG<NGB<SC: ***C. Hamel Desnos***3 N@N9ONOJMMCP>N
NC:N S FB9<<NON@BGJOBPSCBC® * -l

aS< O2™9ON< PBCPGSCN< <9>GZC™>,: O2CMJN QSP™JNC
@B9>G2SJCPB>@B>B9>SMSQ>JPS:OBGSFB9<<N,CJ
@B9>G2JC:™O>9pb; 1(A!,(A%,(A", (Ay,(A), ((A, (((, ((;,
((*, ((#$l

nCFS:J'>N ON PBF@N<<JBC@NCOSN:S@>'<G2JCINP:JBC,
:B9: <NFQGNB<<JQGN¦

n: <9>GN<GBCL9N9>2BCON<N<fr] n^¦

o2S@>'<***C. Boné***, @S<ONOJMMCP>NC:N N y(A N:GN)yA,
@B9>***Kabnick*** .;AA%3FBJC<ON<JLCN<CMGSFFSNBJN:
FBJC<O2SC:SGLJ?9N<GN)yAl

aB9>***Proebstle*** .; AA!3,GN(*; A <NSJNCPB>N FJN9 :BG™,
FSJ<@B9>***Goldman*** GSPBF@S>J<BCN<:JF@B<<JQGN¦

mJQN>6JSGN9MJQN>SOJSGN[CPKBJ6P:9NGGNFN9O:O™
@SCN@>J69FS:™>JN,GN <JGSMJQN>B@:J?9N>OJSGN9
(#"A CF S9>SJ: 9CN FNJGGN9>™PKBL™CJPJON<BC
N6:>™FJO™<:SGNl

nC**2009**, ***J.L. Almeida*** PBF@S>N pGB<9N>S<:CE S9fr]n ^,
@B9>G9GS>OJBM>™?9NC<N9@™>JN9>S<N>

B.C. Disselhoff PBF@S>N, S8NP9C <9J8JON! SC<, GN
P>B<:>J@@JCG2nZf. GS<N>SC<8>SJFNC:>B98N>ON
OJMMCP>Nl

nC**2011**, ***L. Dziecluchowicz*** PBCPG9@>'<S8BJ>PBF@S>™
F™:KBON<2SQGS:JBC>FJ?9N B9:N<PN<F™:KBON<
<BC:NMMJPSFN<Â>N< <J9CN™CNJ>NS@@>J™N<:
PB>NP:NFNCO™GJ8>™Nl

B. Siribumrungwong, OSC<9CNF™:S{SCSG5<PBCPG9:
?9NGN<KN>FJ?9N<:S9<<JNMMJPS9NGSP>B<<NP:BFJN
<:>J@@JCSJ<S8NPFBJC<O2K™FS:BFN,2JCMNP:JBC,
OB9GN9>S8NP9CN>N@>J<@NG9>S@JONGSJNCB>FSGN
N: ***C. Nesbitt*** ONFSCON@G9G2™:9ON<9>GSFB9<<N1((!,
((%,((", ((y, (((), (;A, (;(, (;;, (;*, (;#, (;!, (;%$l

Le futur

^S@JONNMMJPS@N<PKN>N: CN@N9>QSC@S<GS8JN
?9B:JOJNCON@S:JNCN,GG<N>S :NPKCJ?9ON9M9:9>

FIGURE 11 : Seringues du XIXe siècle.
e9<™NKJ<:BN>ON S F™ONPJ6N>J<l

pKS?9NB9>GS P>B<<NP:BFJ<N>J@@JCN>ON<SON@:N<
S9@>MJONG2NC8S<P9GSJN PKS?9NNPKCJ?9N<BC
<:SCOS>F,FN <JPKS?9N@S:JPJNC<N<KSQJ:9ON<l

aB9>GN<KN>FJ?9NQJNC@@GJ?9:B9N<GN<NPKCJ?9N<
<N8SGNC:NGGN<:GSNCOSCPN<@9QGJPS:JBC9NGGN<l
]N9GSGB>PNPBFFN>PSGNL<B9@N ON @N<JBCN @6
N:GS@>J<NCPKSLN@S>NS<<9>SCPNGNO™@SLNBC:l

fN PKJFJ?9N<N> :B9IB9><@G9>S@JONFBJC<PKN>N:
@N>FN::S9C>NB9>JFF™OJS® S 8JN?9B:JOJNCCNNG
N<:CB:N SNCJ>

nCPS<ON>™PJNJ8CNCB98NGGNINP:JBCNFB9<<NN<:
:B9IB9><@B<<JQGNl

]: SQJGJ<S:N9N FB9<<N PBFFN GS LGB™>JCN ***J.D
Peterson***, ; A((3N: SIB9:ON8S<BPBC<:>JP:NNC<OB ***J.P.
Tiret***3 B9 @™>NJCN9 ***J.F. Van Cleef***3 N@>™<NC:9CN
8BJNON>NPKN>KN1(;", (;y$l

cB:BC< S9<<J GN<CB98NGGNS@@>PKN<NC PB9><
O2™S8G9S:JBC

¤ pGS>N8CE .MJ>BS:JMS8NP 9CN JCINP:JBCN GJ?9JON
<PGB<SC:3

¤] S@KNBCPBGGNSCBSP>5GSCN™@B<®NSJON29C
GBCPS:K™:N>3

¤ fSMBCE .fS<N> MSJQGNFNPKS9MMSC: <PGB<N
FB9<<N3

¤ Z{QGBPHN8JPNOJ<@B<BQM:>9P:PBCJ?9N3l

pN< CB98NGGNS@@>PKN<CN 8BC:{NGGN@S<:>N >B@
PBÂ:N9<NPBF@S>™NGCN<JF@GNINP:JBCNFB9<<Nw

Conclusion

`9N ONPKNFJ@S>PB9>9ON@9GS@>™KJ<NBJ>

fN< <N>JCL9N>SC<@NC:N<O9XiXN<J'PGNGSFB9<<NN:
GNPBC:>ÉGNPKBS@KJ?9N09 XXN >™BG9:JBCCNGN
:>SJ:NFNCON<<S@K'CN8S>J?9N9<NFS<:SCOS>J<S:JBC
ONGSNPKCJ?9N FB9<<N, MSQ>JPS:JBC,NF™:KBON
O2JCINP:JBCNCFS>PKN ***E. Rabe***3l

r9 O™Q9 9XX N <J'PGN NPKJ>9 NCSQSCOBCCN N Ù B LFN ONGSP B<<NP:BFJ N 8N9GNC N @GSPK N <:>J@@ SS2NC 8N BCN96KN>FJ?9Nl

fN< :NPKCJ?9N<@KS>FSPB{F™PSCJ?9 NSCCBCPNC: @B FN::N9<N<@B9 N<S@K'CN N L>SCO<OJSF':>N<l

Références

(l mN S Sm kNB LJN el fN< L>SCO<<9IN:<ONGS@KG™QBG BLJN ;(l fS <PGB ™K™S@JN GSPKJ>9 Na KG™QBGB ALA N0 %. (3_ %;{#l

;l 8SC ONCq>NFN>hl, eBGG l jJ<:B>JPS 8N 8JN7BM 8S>JPB<N 8N C<9 LN>5r CCZS<Pl]9>Ll ;A(A r@>0 ;#.*3 _ #%{*;l

*l YSLCBC kl iC:™>,: ON GS@N>M9<JBCS{B<<N9<NPKN4 G2SO9G K\ N ;A(A, c¥ **A#l m S9G:c SCP5l

#l eSIB>hlol pKJ>9 JSCM9<B>J 2 %#Z J-JQC<N9>777 lQBBH<l LBBLGNlM>

!l oNC5<hlql, nFFN>N:4l r GN::N>PBCPN>CJKSCLCN7 7S5 BM P9>JCL<9CO>5OJ<NS<NQ5 :>SC<M9<JB M QGBBO aKJGB<B@K J SG SP:JBC B5 SQ BPJN:5 %%'0 ; _ #y){)Al

%l eB<4H B JN4 fl \>NS:FNC:BMZS>JPB<NZNJC<7J:K]9LS> iCINP:JBC PBFQJCNOJ:K 8NJC GJLS:JBC ZNC:>SGQGSM9> pKJ>9 JN();" 0 ;y _("*({%l

"l ON\SHS:<kl rFQ9GS:B>5 LS:JBC BMKN]S@KNCB9 ZNJCl \KN hB9>CS BMKNrFN>JPS ONOJP S<BPJS:JB(A 0)#, (%_ (){#{"l

yl mN 9<BC fl fJLS:JBC BM ZS>JPB<NZNJC<, rFQ9GS:B>5 \>NS:FNC:a>NGJFJCS 5]PGNB<JCLiCINP:JBC CCSG BM]9>LN>5)*! 0 ZBG pii _*A#{(#l

)l ZJC m pKGNJ l ZSCpGNNM rGGS N l '8 SG9S:JBC 29CN CB98NGG NPKCJ?9S FQ9GS:B N >S:NFNC:ON<8S>JPN< S<<BPJS NP:JBC <PGB ™K™S@JN <<S@K'CN C:N>CN< ONL>B<PSGJ Q<:NPKCJ?9 l aKG™QBG)#N0 #, C¥*_ ;*"{#%l

(Al ^B9Q5 a o 9 :>S:NFNC:ON<8S>JPN N: <@™PJSGNF NC: @B P™Q@ SS N CINP:JBO N GJ?9N 8BOB{:SCCJ?9 S J<_ oNGSKN 5 (y%"l

((l bPK<CN l, N: SGl pBF@S :J8 ZSG9N BMiC:>S8NCB9<]PGNB<JCL9Q<:SCPN<l>PKJ8<BM]9>LN>5()*# 0 8BGl), * _ *)"{#(%l

(;l qJNLNGNJ<JNC mS5 rPJO]BG9:JBC<MB>:KN iCINP:JBC \>NS:FNC:BMZS>JPB<ZNJC<rCCSG BM9>LN>5()*" 0 8BGl pZ _ %A{!l

(*l]PKFGN l pGJCJPBBF@S>J<BBCMJPGNB<JCL]BG9:JBC C iCINP:JBC NS:FNC:BMZS>JPB<NJC<,oNGS5O]GB9LK_ ^NP9>N CPN BMZS>JPN<lKN rFN>JPSO B9>CS BM]9>LN>5 ()*" 0 8BGXXZi(_*y){)yl

(#l pKGNJ l ZJC ml]PG™>9 *versus* :K>BFQ9<l rP:9SGJ:™< 8S<P9GS JC:N>CS:JBCS)N<0 *! _ (y{;Al

(!l ^NJCNF \KN rP:J8J:5BM CJBCJP9>MSP NP:J8N pBF@B9CO< JCa>BO9PJC ZS<P9GS SQGJ:N>JBC],9>MSP NP:J8N]PGNB<JCL rLNC:<,a>BPNNOJCBM KN]BPJN:5MB n6@N>JFNC qSBGBL5 SCO eNOJPJC)#% 0 8BG %; _ #){!#l

(%l hSC{pK>J<:BK@K YBGGFSC@ l \KNjJ<:B>5BM]PGNB<JCL mBSF<l oN>FS:BG 9>Ll ;AA# 0 8BG A, ! _ %)#{"A*l

("l jNC>JN:hla mBSF]PGNB>KNS@5]: S:N BM:KN r>:l aS>J<_ 'OJ:JBCaKG™QBGBLJ 9SNCqSJ<N<;AA(_ '"*{yl

(yl]SOB9C]l p>J:'N< @B9>GSMSQ>JPS:JBZ9CNFB9<<N <PGB ™<SC:N ON?9SGJ:aKGNQBGBAL(5 0 %,(_ ;%{*(l

()l eP r9<GSCQ \KN FBON>C>NS:FNC:BM8S>JPB<8NJC<l eNOla>N<pJP9GS)*) 0 ;A(_ #A#{(Al

;Al b>QSPKlhl]PGNB>KNS@5BM8S>JPB<8NJC<9:JGJ4S:JBKSC JC:S8NCB9<SJ>QGBPHFl hl]9>Ll ()## 0 fXZi.*3 _ *%;{%l

b>QSPKlhl,aN>N::Jrlgl \KN:K>BFQBLNCJ@B@N5>BMMBSF BM 5CKNJPSCJBCJPONN>LNCl rCL JBGBL5()! A 0(_;*" {#*l

;;l mB:N ^l^l \KN JCINP:JBC NS:FNC: iC ZS>JPB<NZNJC<, jSNFB>>KBJOSCO b:KN> pBCOJ:JBC<BCOBC_ fN7J<0 ()## _ (*{##l

;*l]JLL gl cN9N N LN<JPK:<@9CH A9> \NPKCJH ON> ZS>JN CQNKSCOG9KNL[F<PKl()#) 0 %_ (;"{*#l

;#l ^NN rl n:SFBGJ MBSFJC:KN:>NS:FNC BM8S>JPB<8NJC<r CN7FN:KBOrP:S oN>FS:BG NCNBG()!* 0 ** _ #*!{%l

;!l ZBC j SC<q>9PHN N: SG KN PBFQJCN MBSF<PGB N<J<BM 8S>JPN¥ JNCN NOJ4JCJ<P KBNPKNC<PK>{)M: 0 ZBG A#, (_((({*l

;%l eS5N> jl, q>•PHN jl rCLJBGBLJN9> ì:JBGBLJN9CO qNKSCOG9C N>ZS>JN C ON>9C:N N C n6:>NFJ:S:NC pKJ> a>S6l()!" 0 #_ !;(l

;"l jS9N>kl iC NC:B N>FSC S:NC:on *# (" (y; p;l V7JGGJCL<{]@>JN C{]N:()y#l

;yl eBCM 96rl \>SJ:NFNC<PGB ™<SCON<>BCP<S@K™CJN C< GN9>P BGGS N ON L>B< PSGJ Q<S> GSF™:KBON F9<l aKG™QBG)"JN0 !A _*!({*l

;)l eJCLB kS>FS hl n<PGB N<J<8NCB<SPBCN<@9FS_ mBSF eNOJPSG <:NFl ^N8J<:S n<@SCB ONS eNOJPJC5 pJ>9 JS pB<FN:JP)) 0 " _ ;){*(l

Al]SC:B< kS<:BC el n<PGB N S@JS@B>eB9<<N .N<@9FS3l n<PGB KNS@JS NZS>JPN<SO>JQ ZNLSGB() _ '"{"l

*(l m9GGJCJCN7 :NPKCJ?9NC@B O9PJC LPGB N<JCL MBSF CS OJ<@B<S 5 NCL N FS:BG 9>Ll ;AAA 0 ;% _"A!{%l

;l \N<<S>Jl cB98NGG NPKCJ?9N 2BQ:NC:JB N GS<PGB {> FB9<<Na KG™QBGBALAN0 ! _(;)l

**l pS8N44Jrl, m9GGJC J ^JPPJl, \N<<S>Jl \>NS:FNC:BM 8S>JPB<8NJC<Q5 MBSF<PGB KNS@5:7B PGJCJP SGJN<l aKGNQBGBALA 0 (" _(*{yl

#l kSPKN:kl [CN CB98NGGFN™:KBON JF@GN ™PBCBFJ?9N @B9P BCMNP:JB CONGSFB9<<N@B9<PGB N<™PKBL9JO™Nl aKG™QBGBALAN0 !# _%{!l

*!l pSQN S h, pSQN S kS>PJS{GFNOB l^l c9N8B FN BOBON N<PGB J NCGS 8S>JPN<BCP9GS laS:BGZS<Pl())! 0 #_ !!{"*l

*%l qKB7FJPH rl, jS>@N>ol, Y>JLK: o, ePpBGG9F plcl aBGJOBPSC FBBMBSF<PGB KNS@5MB SBCL<S@KNCB9< 8S>JPB<8NJC<aKGNQBGBALA 0 (% #({!Al

*"l b98>5al, qS>NGGJN l, n<PSG S hel, N: SG JPGNB>KNS@5 BMKNGBCL<S@KNCB8NJC7J:K MBSF BM S9>BFSP BLBGS_ @B<@NPNJ9@GNFBCB GGN SCOBFJ4O<:9O5@B:BPBG SCO MJ>N 9GJC:l rCLJBGAA(0 ;A.]9@@(G _ *#*l

"!l]PKSCCBl{mGNFB>PBSL9GS:JBC>J:JPSGSG5<BM:<9<N S<SCSOI9CP2C<9>LN>5MB8S>JPB<8NJC<lCLJBGBL(5%y 0 () _ ;yy{};l

"%l YS::< kl\ l nCOBNCB9<OJS:KN>F5N<:>9P:JBBMJC:N>CSG <S@KNCB9<h ()"; 0 #_ !*l

""l b2^NJGG5 nCOBNCB9<OJS:KN>F5PGBN>J<BM8S>JPB<N 8NJC<l9<:l cl Vlhl]9>Ll ()"" 0 #_ *)*{!l

"yl]: SGG7K>hlel, aGBCHl>kIYl r <JF@GJMSNCNMMJPJNC: FN:KBCMB>NS:JCBS>JPB<8NJC<]9>LN>5(") 0 y% _"%!{ yl

")l ZSC pGNNMMf S CB98NGC7NGNBP>BSL9GS:JBC@KG™QBGBLJNl aKG™QBGBy"JN0 #A .;3 _ #*{%l

yAl k>SOFSCYl]l ZNCB<PB@BPGJSNJBCBM8S>JPNS>JQ9:S>JN< 9<JCLFBCB@BGSNBP>S9:N>5 @NGJFJCS>5@B> hl oN>FS:BQ9>Ll bCPBG(l)# 0 ;A _#y;{!l

y(l kBGOFSCla l pGB<9>BMKNL>NS:N><S@KNCB9NJC7J:K NCOBG9FJCSSGJBM?9NCP5KN>FSGKNS:JCLBM:KN 8NJC 7SGGJC PBFQJCS:JBC7J:K SFQ9GS:B>5@KGNQNP:BF5_ @NGJFJCS%eBC:KMBG7@ o N>FS:BQ9>Ll ;AAA eS5 0 ;%.!3 _ #;{%l

y;l eJ:PKNGl, kBGOFSCol pGB<9>BMKNk>NS:N}S@KNCB9< ZNJC7J:K nCOBG9FJCSSGJBM?9NCP5KN>FSGNS:JCLBM :KNZNJCYSGGJCpBFQJCS:JBC7J:KrFQ9GS:B>5KGNQNP:BF5_ a>NGJFJCS%5eBC:KmBG7@ o N>FS:BQ9>Ll ;AAA 0 ;% _ #!;{%l

y*l pKSCOGNKl, aJPKBbl,]N<<Spl, N:SGl>NS:FNCBM@>JFS>5 8NCB9< JC<9MMJPJNQ5P5NCOBNCB9< <S@KNCB98NJC BQGJSNJBCZS<Pl]9>Ll ;AAA 0 *# _;A({(#l

y#l gJ<:CN>^lfl nCOBS<P9GS:BQGJSNJBC BM:KN L>NS:N> <S@KNCB98NJC_:KN PGB<N>@BPNO9Nl h@Cl aKGNQBGl ;AA; 0 (* _*;!{**l

y!l YNJ<< ^lrl, YNJ<< elrl pBC:BGGNG>SOJBM?9NCP5 NCOBNCB9< BPPG9<JBGCJCL S 9CJ?9N>SOJBM?9NCP5 PS:KN:N9CON>O9@GNL9JOSCP1B NGJFJCS<NS@KNCB9< 8S>JPB<8NJC>NMG96S_ ;{5NS>MBG7@ o N>FS:BQ9>Ll ;AA; 0 ;y _*y{#;l

y%ljJCLB>SCJla l, r<PKN>l, eS>HN8JPK N:SGoNN@8NCB9< :K>BFQB<J<SM:N>SOJBM?9NCP5SQGS:JBCM:KN L>NS:N> <S@KNCB98NJC_ S7B>O BM 9?9:JBChlZS<Pl]9>Ll ;AA# 0 #A_ !AA{#l

y"l p>N:BCol, N: GNL>B9@pGB<9>F bQGJ:S"JBC>BCP9GSJ> <S@K'CN@S>GN@B>P™O™SOJBM>™?9NZCP]N pGB<9>F_ >™<9G:S@<! SC< ONG2™:9OPNG:JPNC:>J?@B<@NPNJ8 aKG™QBGBPLAN0 !) _ %"{";l

yyl f9 F<ONCrlql, aNONCnlgl pGJCJP9>GNBM:KN CN7 Zc[] pGB<9>m] \ >SOJBM?9NCP5PS:KN:N>nCOBS<Pl\BOS5 ;AA".]9@@G3"{(Al

y)l a>BNQ<:CNl, rGF hl,kæPHN>Jl4 YNC4NGpl, cB@@NCN5 fNQSO pl, aJPKBbl,]N<<Spl, p>N:BCol n9>B@NSPGB<9>m S: pGJCJP?9GO5k>B9@\ K>NN{5NS>n9>B@NSMBG7@B@BM NCOBNCB9< >SOJBM?9NCP5{@B>O <NLFNC:SGKN>FSG SQGS:JBBM:KN L>NS: <S@KNCB98NJC 7J:K B> 7J:KB9: :>NS:FNCBMPSGJB>JPB<J:JNlZS<Pl]9>Ll ;A((h9O !#.(3 _ (#%{!;l

)Al qNGGFSQl, rOSF<{^S5 hl ZS<P9GS>NSP:JBC<SM:N> N6@N>JFNCP:BGCCI9>5CLJBGBL(J)% 0 " _ **){%"l

)(l pBFFJCL^l, f5HHNlelhl iCPNS<N8S<P9GS@N>FNSQJGJ:5 N8BPNQ5PBGJCCI9>5aS:KBGBL(5*, ! _ (A"{(!l

);l]JG8J9{oSJC]PGNB{>NM>JSNJBCBM8S>JPN<cB98 a>N<<N eNOl()"y bP: (# 0 ".*!3 _ *(#yl

)*l eJGGNN>^l, fN aJ8N> al p>5B<PGBK>J<BM:KN <S@KNCB9< 8NJC<JC8S>JPB<NMG9JC:KNBQN<SNCONGON>aG5GNQBGBLJN ()y(0 *#.#3_ %A({!l

)#l WJnlhl, fNN]ljl, pKB hljl, gJF gl\l nS>G5N<9G:<BM P>B<9>LN>5 JC 8S>JPB<N8NJC< JC gB>NS_ <SMN:5SCO MNS<JQJGGB:NSChl\KB>SPlpS>OJBS<Pl]9>Ll ;A(; h9C0 #!.*3 _ (!!{%Al

)!l qBC™pl \>S:SFJNC:BNCOBG9FJCSNGS<8S>JPNP>BCGS<N> ONOJPB_N<9OB @NGJFCS>5^N8aS:BGZS<Pl())) 0 ! _ *!{ #%l

)%l eJC ^lhl, VJFFN:]lnl, i<SSP<elcl, mB>N<:SGelol nCOBNCB9<fS<N>>NS:FNC: BM:KN iCPBF@N:NC>NS:N>]S@KNCB9ZNJChlZS<PliC:Nal ^SOJBGAA(0 (; _ ((%"{"(l

)"l cS8S>B fl, eJC ^lhl, qBCNpl nCOBNCB9<GS<N>S_ON7 FJCJFSGBS8<JBN FN:KBGBM>NS:FNC:MB8S>JPB<8NJC< @NGJFJCSBEQ<N8SJBC<9<JCLSC y(A CF OJBONGS<N> oN>Fl]9>Ll ;AA(mK0 0" _ ((";;l

)yl a>BNQ<:CNl, fNK>jlrl, gS>LG l, n<@JCB<S{gGNJB:KN> Yl , qNK:LNl, gCB@BlnCOBNCB9<>NS:FNCBMKNL>NS:N> <S@KNCB98NJC7J:K S)#A{CF OJBONGS<N>K>BFQB:JP BPPG9<JBBM:NNCOBG9FJCSSGJ>FSGSFSLNQ5 GS<{N> LNCNS>NG<:NSFQ9QQGNKZS<Pl]9>Ll ;AA; 0 *! _ ";){*%l

))l ZSC pGNNMMm]JC:N<al,] 9>JN>hlpl,]S>MS:Jl ^N:>SJ: FB:B>J<™29CNMJQ>fr] n^ NCOBNJCN9<NaKG™QBGBLJN ;AA! 0 !y, * _;#*{%l

(AAlZSC OCq>NFN>hl, hBB<:NGlal, j SFFJCL hlm, eBGGnl iF@GNFNC:S:JBGNCOBNCB9<GS<N>SQGS:JBCM8S>JPB<N 8NJC< JC S S>LN PBFF9CJ:5 KB<@J:SGKN MJ><#AA @BPNO9N<ln9>l hlZS<PlnCOBS<Pl]9>Ll ;AA) 0 *" _ #y%{)(l

(A(l jSFNG{oN<CBpl, k™S>O Hfl, oN<CBal fS<N>NCOBNJCN96 KB><QGBB@™S:BJN _™:9ONMSCPB{<9J<<N™B><@NPNJ8 F9GJPN:>J?9NON(" AAPS<laKG™QBBLJN A) 0 %, (_() {;" l

(A;l ZSC OCqB<^l^l, eJGGNN>l, cN9FSCOel, cJl<:NCl a>BBM{ BM{@>JCP3@OSBM<:NSF SQGS:JBS< CBNG KN>FSG :KNS@5MB>S@KNCB98S>JPB<8NJC<hlZS<Pl]9>Ll ;A((hSC0 !*.(3 _ (y({%l

(A*l ^S5FBCO{eS:JFQNS9al]PGNB>KNS@5BM:KN JC:N>CSG <S@KNCB98NJCJC:KN <:SCOJCSSCO<J::JCL@B<J:JBCl PBF@S>J8N <9O5 aKGNQBGB(J)JN hSC{eS9 #(.(3 _)"{ (A" 0 CJ<P9<<JBC(A"{(Al

(A#l ZSC pGNNMmpBFFNC: :NCJ9CN<N>JCL9NC@GS<:J?9N rZ i ())% 0 *" _ (y{)l

(A!l jSFNG{oN<CB<pl, oN<CB<al, Y BGGFSCOlpl, N: SGl n8SG9S:JBBMKNNMMJPBM@BGJOBPSJCBG>FBMMBSF PBF@SN>O:B GJ?9JCB>FJC<PGBNKNS@5BMKN L>NS:N> <S@KNCB98NJC_JCJ:JSG9G:<oN>FS:BQ9>Ll ;AA* 0 ;) _ ((("A{!l

(A%ljSFNGoN<CBpl, rGGSNhl, qNCJLOla, qBJ:NGK, pKGNJ> mlb98>5al,] PKSONPl, oN<CBal eB9<<NON@BG5™PSCBG *- *versus* (- OSC<GSL>SCONBNJCN<S@K'CN @NFJN>< >™<9G:SaKG™QBGBPLAN0 !y, ; _ (%!{"*l

(A"l rc rn]l \>SJ:NFNC:<ON<8S>JPN<ON<FNFQ>N<JCM™>JN9><,((l]: æ::N>l,]PKSSM, qBPHNGQ>JQ<BF@S>:J8 B9:PBFN<
h9JC;AA#l hleSGLZS<Pl;AA! 0 *A _(#{##l BM>SOJBM?9NCP5NCOBG9FJCSQGS:JBCJC8LJCS:JBC
<:>J@@JSCOP>B<:>J@@JCL:KN :>NS:FNC:BML>NS:
<S@KNCB8NJCaKGNQBGBAL5%0 ;(_%A{#l

(Ayl Y>JLK: ol, kBQJCha, q>SOQ9>5lY l, N: SGlZS>J<BM8
@BGJOBPSCB8NJC:KNFSCSLNFNCBM8S>JPB<8NJC<JC:KN (;Al jJCPKGJMMN [KQJ hl, qNNPKrl, N: SGlr @>B<@NPNJ8
@N<NCPNBM:>9CH8NJC JCPBF@N:NCPNS_B@NSC?p\ l >SCOBFJ<NPBCBGGN>OSBMc[] pGB<9>versus <9LN>5
aKGNQBGBAL5%0 ;(, # _(yA{)Al MB>KN :>NS:FNC:BM>N?9>NC:GBCL<S@KNCB8S>JPB<N
8NJC<h9>lhlZS<PlnCOBS<Pl]9>Ll ;AA%0 *(_;(;{yl

(A)l kJGGNltl, k9N6 hlhl,rGGS:Nhrl, pKGNJnliCPJONCPN< (;(l aN>SGShl, ^S9:JB \l , qJSCPS>dl N SGl^SOJBM?9NCP5
PBF@GJPS:JBNCB9<PGB:k™S@JN S FB9<<N_ >™<9G:S:< NCOB8NCB9< BQGJSNJBCversus <:>J@@JBCM:KN GBCL
ON G2™:9ON GS]BPJ™:™MSCµSJ<NON aKG™QBGBLJNl <S@KNCB8NJC<*{5NS>B9:PBFNBMS >SCOBFJ<O<:9O5r CClZS<Pl
aKG™QBGBAL5N0 !y _*#){!(l]9>Ll ;AA! 0 (_({#l

((Al kJGGNltl, k9NON<hlel, k9N6 hlhl,N: SGJONNMMNBSCO (;;l oJ<<NGKBMl,MON>gJCONNColhl, gNGONhpl,eBGGll mJ8{
PBF@GJPS:JBNCB9MBSF<PGBk:KNS@5BMKNL>NS:SCO<FSGG 5NS> >N<9G:<BMS >SCOBFJ<O PGJCJPSGSCPBF@S>JCL
<S@KNCB8NJC<,S PBC:BGGN<9G:JPNCt>@B<@NPNJ8 NCOB8NCB9<GS<NSQGS:JBCK P>B<:>J@@JCL:L>NS:
<:9O5JCPG9OJCL @S:JNCaKGNQBGBAL5 0 *# _(*({ <S@KNCB8NJC<lq>l h] 9>Ll ;A((r9L 0)y.y3 _
yl ((A"{((l

(((l k9N6 hlhl pBF@GJPS:JBSCO <JON{NMMNBM MBSF (;*l rGFNJONil,gS9MFSCl,kæPHN>Jl4pKB@S>a, n8SC<el\ l,
<PGBk:KNS@5aKGNQBGBAL5) 0 ;# _;"A{#l jBKNJF olml, eSHKB9Cl'kl, ^JPKSC><\l , Y NCANGpl, ^SJCN<
hlgl^SOJBM?9NCPNCOB8NCB9<pGB<9hm] \ versus GS<N>
((;l m9GGJCJ, mKGJPNhl q9>PKJNGJC,J oJ]: NMSCBl jJLK SQGS:JBCB>KN :>NS:FNC:BML>NS: <S@KNCB8NJC
@BO9P:JBCMNCOB:KNGSJC:NMBSF<PGBk:KNS@5S CN7 <S@KNCB8NJC<lq>l h] 9>Ll ;A((r9L 0)y.y3 _
@S:KBLNCN:J5@B:KN<JMB>CN9BGBLJPSGCO 8J<9SG ((A"{((l
OJ<:9>QSCPBM:KN>PGBk:KNS@5aKGNQBGBAL5 0 ;%.!3_
;A*{yl

((*l b98>5al, r GGSNdhl, oN<CB<al, j SFNG{oN<CBl<nMMJPSP5 (;*l rGFNJONil,gS9MFSCl,kæPHN>Jl4pKB@S>a, n8SC<el\ l,
BM@BGJOBPSCB8NJCversus GJ?9JCL<PGBk:KNS@5BMKN jBKNJF olml, eSHKB9Cl'kl, ^JPKSC><\l , Y NCANGpl, ^SJCN<
L>NS:<S@KNCB8NJC F9G:JPNCt:SCOBFJ<NPBCBGGNO hlgl^SOJBM?9NCPNCOB8NCB9<pGB<9hm] \ versus GS<N>
:>JSCJ:K S ;{5NS>MBG7{B@ n9>l h ZS<PlnCOBS<Pl]9>Ll SQGS:JBCB>KN :>NS:FNC:BML>NS: <S@KNCB8NJC
;AAy 0 *%.*3_ *%%{"Al <S@KNCB8NJC<lq>l h] 9>Ll ;A((r9L 0)y.y3 _
((A"{((l

((#l WSSHJN: SGlpBF@SS>JBl <9O5 BMO9@GN6{L9JCMBSF (;#l o4JNPJ9PKBP4fl, g>S<JC<HJ, g>9<45CSl, n<@JCB<kS
<PGBk:KNS@5SCOO9@GN6{L9JCMN?9JCPGBk:KNS@5MB> r<<N<<FNCBMKNfN8NCBMoJMMJPBSM59>\NPKCJ?9NBM
:KN:>NS:FNCBM<9@N>MJBNCB9<JC<9MMJPJMNCPF5S:BGl nCOB8NCB9<\KN>FSGQGS:JBCMKNk>NS:]S@KNCB9KNJC
]9>Ll ;AA# 0 *A _"(y{;;l SCOKNnPKBLNCJPB5MKN\J@ BMKNYB>HJCLN8JPNC
ZJBEr CCLZS<Pl]9>Ll ;A(; 0 bP:()l

((!l oS>7BBOlhl,\KNJ8SP9FS>l, oNGGSEFS:JPS<ol, eS8B> (;!l]J>JQ9F>9CL7BCQl, cBB>J:al, YJGS<>9<FNJN, r::JS hl,
rlil, kB9LK elhl ^SCOBFJ<O PGJCJPSGSCPBF@S>JCL \KSHHJC<:JBCr <5<:NFS:JP>8JN7SCOFN:S{SCSG5<BM
NCOB8NCB9<GS<NSQGS:JBCK <9LN>5MB>KN:>NS:FNC: >SCOBFJ<NOPBCBGGN>JSG<PBF@S>JCLNCOB8NCB9<
BM@>JFS>L5NS:<S@KNCB8S>JPB<8NJC<lq>l h] 9>Ll SQGS:JBCO<9LJPSGC:N8NC:JBCJC@S:JNC7:K8S>JPB<N
;AAy 0)! _ ;)#{*A(l 8NJCln9>l hlZS<PlnCOBS<Pl]9>Ll ;A(; r9L 0 #.;3 _ ;(#{
;*l

((%l ^S9:JB \l , bKJCFSSrl, aN>SGShl, N: SGlnCOB8NCB9< (;%l cN<QJ:pl, nJMN9GC, pB5CNal, qSO>jl, qKS::SPKS>5Z5
BQGJSNJBCversus PBCB8NC:JBCSG>J@@JBC@NS>JCLJC:KN]: SC<QklnCOB8NCB9<SQGS:JBCSOJBM?9NCP5SCOGS<N>3
:>NS:FNC: BM @>JFS>B5S>JPB<8NJC<_S >SCOBFJ<NO SCOMBSF<PGBk:KNS@5versus PBCB8NC:JBCS<9LN>5MB>
PBCBGGN>OSBGJ:KPBF@S>J<BMKNPB<:<hlZS<Pl]9>Ll L>NS:<S@KNCB8NJC8S>JPNpBPKSCNoS:SQS<]5 <:^N8l
;AA; 0 *! _)!y{%!l ;A((0 bP:!l

((''l f9 >JNnl p>NBCol, nHGBM, N: SGla>B<@NPNJ8SCOBFJ<NO (;'l aNN><BChlol, kBGOFSQelal r C C8N<:JLS:JB6C :KN
<:9O5BMNCOB8NCB9<>SOJBM?9NCPBQGJSNJBCpGB<9N> JCMG9NCBM LGBN>JCBC <PGBk:SC: MBSF <:SQJGJ:5
@BPNO9N3versus GJLS:JBSCO<:>J@@JCLS <NGNP:NO aKGNQBGBAL5]N@0 ;%.%3;*;{#l
@S:JNC@B@9GS:JBCf Zn]] :9O53hlZS<Pl]9>Ll ;AA* 0
*y _ ;A"{(#l

(;yl gN>Cal, ^SFNGNhlrl, Y9:<PKN>^l, eS44BGSJl r OB9QGN{
((yl aN>>JQel nCOBG9FJCSNGS:FNC:BMGBN> CFQ 8S>JPB<N QGJCO;SCOBFJ<NO <:9O5 PBF@S>JCQ@9N> PK>BFS:NO
8NJC<Q5NCOB8NCB9<GS<NSCO>SOJBM?9NCP5NPKCJ?9N<l LGBN>JCJ:K PKBFS:NOLGBN>JCJ:K (- GJOBPSJCON
aKGNQBGBAL5# 0 (_("A{yl N@JCN@K>MCN<PGBk:KNS@5BM:NGSCLJNP:S<SSCO
>NJP9GS8NJC<lN>FS:BQ9>Ll ;A((cB8 0*".((3 _ ( )A{#l